



Library of the Museum
OF
COMPARATIVE ZOÖLOGY,
AT HARVARD COLLEGE, CAMBRIDGE, MASS.

The gift of

*the Eliza Smith-
ell Scientific Society*

No. 11726

Jan 31, 1888



M. A. Curtis

0

JOURNAL

OF THE

Elisha Mitchell Scientific Society,

FOR THE YEAR

1884--1885.

PUBLICATION COMMITTEE:

R. H. GRAVES,
J. A. HOLMES,
W. B. PHILLIPS.

C.

RALEIGH, N. C.:

EDWARDS, BROUGHTON & CO., STEAM POWER PRINTERS AND BINDERS.
1885.



OFFICERS.

1884--1885.

PRESIDENT—W. C. KERR, PH. D.

VICE-PRESIDENT—W. J. MARTIN, A. M.

RESIDENT VICE-PRESIDENT—J. W. GORE, C. E.

SEC. AND TREASURER—F. P. VENABLE, PH. D., F. C. S.

EXECUTIVE COMMITTEE.

R. H. GRAVES, B. Sc., C. & M. E.

J. A. HOLMES, B. Agr.

W. B. PHILLIPS, Ph. D.

JOURNAL
OF THE
ELISHA MITCHELL SCIENTIFIC SOCIETY.

REPORT OF THE RESIDENT VICE-PRESIDENT
FOR THE YEAR 1884-'85.

J. W. GORE.

The second year of the Mitchell Society is now completed; and it is gratifying to be able to report a successful year.

It was feared by some of the friends of the Society that the very commendable interest expressed and maintained during the first year would wane, and the Society languish somewhat, or require greater effort on the part of a few to support it and keep alive the interest in its existence. Hence it was with great solicitude that its progress was watched; and now that another prosperous year has been added to its life, it is with increased confidence that we regard the Society as permanently established, and worthy a more hearty support and co-operation of those interested in, and desirous of, the prosperity of an organization which proposes to use every effort and employ all means for increasing and disseminating a knowledge of science.

During the year there was a series of four public lectures given under the auspices of the Society by Prof. Winston and Dr. Venable, of the University, Dr. Thos. F. Wood, of Wilmington, and Prof. J. H. Gore, of Washington, D. C. The members of the University and citizens of the town attested their appreciation of the opportunity for instruction these lectures afforded by their presence and attention.

There were also held, during the year, six regular monthly meetings for the reading and discussion of papers presented. These meetings were limited to members and invited guests, and were well attended and very encouraging interest was taken in the exercises.

This separation of the more popular feature of the work we had allotted ourselves from the more technical or scientific work of the Society, has proven by experience to be a happy solution of the complex problem of interesting the public in the aims of the Society,

and of stimulating the members to take an active part in presenting papers on technical subjects and the discussions they call forth.

The character and amount of work done during the year can best be estimated by the Journal and reference to the Secretary's report.

It is a pleasure to note, and it may not be out of place, the recognition by some of our Southern States of the material assistance science may afford when properly directed. As examples of this, we would refer to the well equipped and ably conducted Experiment Station of this State, and a similar institution in South Carolina, each of which is doing valuable work in the interest of their respective States and science. We trust this is but a beginning of a revival of science in the South, and we wish to put our shoulder to the work and help it bravely on.

The success which attended the issue of the Journal for the year 1883-'84 was very flattering. If it were appropriate, the compliments of the various journals and newspapers of the country might be cited.

Some of the papers have been republished in the Journal of the American Chemical Society, and in the London Chemical News. Some have been mentioned in the Smithsonian Report on the Year's Progress in Chemistry. One of the papers has also appeared in the North Carolina Medical Journal. These form most pleasing evidences of the value set upon our work, and it is just such recognition that we are trying to win.

These encouragements to our efforts should act as a stimulus to more earnest effort, that the expectations and hopes of friends may be realized.

The object of the Journal is now well known, though we regret that but few members of the Society, who do not have the privilege of attending the meetings, make use of the Journal as a means of recording original work and observations, and as a vehicle of communicating their results to others.

It is hoped that our members will recognize and appreciate the advantages the existence of the Journal offers, and avail themselves of the opportunity and encouragement it supplies.

Following the precedent of the previous number of the Journal, and in fulfilment of a partial promise, the present number contains the portrait and a sketch of the life of Dr. Curtis. It is hoped in the third number of our Journal to present a similar biography of Dr. L. D. von Schweinitz.

REPORT OF THE SECRETARY.

F. P. VENABLE.

BUSINESS MEETINGS.

OCTOBER 3d, 1884.

Prof. J. W. Gore presiding. It was moved and carried that the meetings during the coming session be divided into two classes: Regular meetings, for the especial benefit of the members, at which papers on strictly scientific subjects are to be presented; Public Lectures, which are to be on some general popular subject, for the entertainment and instruction of the public at large. These meetings are to be held at such times as may seem suitable and convenient to the Council.

MAY 25th, 1885.

Prof. J. W. Gore presiding. This was the regular meeting for elections. The official reports for the year were discussed and ordered for printing in the Journal.

The following officers were elected for the year 1885-'86: President, Dr. Thos. F. Wood; 1st Vice-President, Dr. W. B. Phillips; 2d Vice-President, Prof. J. W. Gore; Secretary and Treasurer, F. P. Venable. Executive Committee: R. H. Graves, J. A. Holmes. One place on the Executive Committee was left vacant, to be filled by the Council.

The following Honorary Members were elected: Dr. J. W. Mallet, University of Virginia; Dr. H. Carrington Bolton, Trinity College, Hartford, Conn.; Dr. A. W. Chapman, Apalachicola, Fla.

The treasurer was instructed to get estimates for printing the next Journal.

For the coming year it was decided that the biography should be that of Dr. Louis D. von Schweinitz, and the Secretary was instructed to correspond with the family as to the choice of a biographer. The meeting then adjourned.

REGULAR MEETINGS.

Five public meetings were held for the presentation and discussion of scientific papers. At these meetings forty-three papers were presented. During the session, also four public lectures were given under the auspices of the Society.

NATIONAL HISTORY LECTURE ROOM,
OCTOBER 18th, 1884.

1. Report on the British and American Association Meetings
for 1884, J. W. GORE.
 2. Constituents of the Yopon Leaf, F. P. VENABLE.
 3. Transpiration of Water by Plants, F. P. VENABLE.
 4. Flora of Angola Bay, J. A. HOLMES.
- December 5th, 1884.*
5. Recent Progress in Engineering, J. W. GORE.
 6. Analysis of Crystals of Dog-tooth Spar, W. B. PHILLIPS.
 7. Analysis of Salt-boiler Deposit, W. B. PHILLIPS.
 8. Analysis of Zinc Furnace Deposit, E. A. DE SCHWEINITZ.
 9. Analysis of Specular Iron Ore from Forsyth county, I. H. MANNING.
 10. Examination of some Chapel Hill well-waters, J. C. ROBERTS.
- February 7th, 1885.*
11. Use of Balloons in Meteorology, J. W. GORE.
 12. Mercurous Hypophosphite, E. A. DE SCHWEINITZ.
 13. Recent Progress in the Liquefaction of Gases, F. P. VENABLE.
 14. The Jetties at the Mouth of the Mississippi, J. A. HOLMES.
 15. The True Source of the Mississippi, F. P. VENABLE.
 16. Forty Solutions of the "Pons Asinorum," CHAS. PHILLIPS.
 17. Analysis of Spiegeleisen, MAX. JACKSON.
 18. Analysis of Kaolin, I. H. MANNING.
 19. Analysis of Red Hematite from Forsyth county, A. E. WILSON.
- March 7th, 1885.*
20. Sir Wm. Thomson's Theory of Luminiferous Ether, J. L. LOVE.
 21. Meteorological Report for February, F. P. VENABLE.
 22. A Botanical Note, M. E. HYAMS.
 23. Progress in Astronomy, R. H. GRAVES.
 24. Clay-eating, F. P. VENABLE.
 25. Occurrence of Malic and Citric Acids in Pea-nuts, E. A. DE SCHWEINITZ.
 26. Heptyl-benzol, F. P. VENABLE.
 27. Algebra and Acid Phosphates, W. B. PHILLIPS.
- April 25th, 1885.*
28. Arctic Exploration, J. W. GORE.
 29. Observation of Thunder-storms by Balloon, F. P. VENABLE.
 30. A (so-called) Petrified Human Body, J. A. HOLMES.
 31. Peculiar Animal and Plant Life in Geology, J. A. HOLMES.
 32. Additions to Catalogue of North Carolina Plants, M. E. HYAMS.
 33. Character of the Border Rocks of North Carolina Triassic, J. A. HOLMES.
 34. Trap Rocks in Triassic Sand Stone, J. A. HOLMES.
 35. Distribution of Rhododendrom in North Carolina, J. A. HOLMES.
 36. Quantitative Determination of Sugar, J. L. HOWE.
 37. Meteorology of Chapel Hill for the years 1880-'84, F. P. VENABLE.

38. Certain Reactions of Phosphorus, F. P. VENABLE.
 39. Determination of the Latitude of Chapel Hill, J. W. GORE.
 40. Determination of Total Phosphoric Acid, F. B. DANCY.
 41. Common Salt as a Wash for Phosphoric Acid insoluble in
 Citric Acid, F. B. DANCY.
 42. Solubility of Alumina in Sulphuric Acid, MAX JACKSON.
 43. Ammonia in Saliva, MAX JACKSON.

PUBLIC LECTURES.

GERRARD HALL, *November 1st, 1884.*

1. The Domestic Life of the Romans, as illustrated by
 Pompeii, PROF. GEO. T. WINSTON.

NATURAL HISTORY LECTURE ROOM, *February 28th, 1885.*

2. Alchemists and Alchemy, PROF. F. P. VENABLE.

GERRARD HALL, *April 4th, 1885.*

3. History and Objects of Geodesy, PROF. HOWARD GORE.

NATURAL HISTORY LECTURE ROOM, *May 23d, 1885.*

4. Biography of Dr. Curtis, DR. THOS. F. WOOD.

REPORT OF THE TREASURER.

F. P. VENABLE.

	DR.	CR.
Balance in treasury May 1st, 1884,	\$ 134 42	
Additional receipts for 1883-'84,	34 00	
Printing Journal for 1883-'84,		\$ 140 70
Engraving for 1883-'84,		11 53
Express charges,		3 75
Annual dues for 1884-'85,	89 50	
Engraving for 1884-'85,		10 00
Stationery,		80
Postage,		6 02
	<hr/>	<hr/>
	\$ 257 92	\$ 172 80
Amount in treasury August 1st, 1885,	\$ 85 12	

WASHINGTON CARUTHERS KERR.

WASHINGTON CARUTHERS KERR, Ph. D., the second President of the Mitchell Society, died in Asheville, N. C., August 9th, 1885, fifty-six years old. He was born in Guilford county, N. C., and was graduated at the University of N. C., with highest honors in scholarship in 1850. After teaching school in North Carolina, and while a professor in Marshall University, Texas, he was appointed a computer in the Nautical Almanac Office at Cambridge, Mass. Availing himself with great ardor of the opportunities offered by Harvard College, he became the companion as well as the pupil of Davis, and Agassiz, and Peirce, and Lovering, and Guyot, and Horsford, and Eustis, and formed lasting friendships with others renowned in science on both sides of the Atlantic. From Cambridge he went, in 1857, to Davidson College, N. C., as its Professor of Chemistry, Geology and Mineralogy. This position of personal safety he left at the beginning of the late civil war and enlisted as a private in the Confederate army; but was soon detailed to devise methods for, and to superintend the manufacture of salt on the coasts of North Carolina and of South Carolina. In 1866 he became the successor of Dr. Emmons as the Geologist of North Carolina. In 1867-'8 he delivered the lectures on Chemistry, Geology and Mineralogy before the Senior Class at the University of North Carolina. In 1882 he accepted a position in the Coast Survey of the United States, that he might connect his own work in North Carolina with that of the Nation. His labors among the mountains of North Carolina were suspended, because of bodily infirmity, in 1883.

Dr. Kerr was one of the oldest and most active members of the American Association for the Advance of Science, and was connected with several other similar societies. To the archives and to the publications of these bodies he contributed frequently and often largely. Although of a slight physical frame, he was of great energy in body and in mind. He visited every portion of his native State and examined personally its plains, hills, mountains, rivers, creeks, forests, minerals, metals and climate. No man has ever labored so constantly, intelligently, lovingly and successfully to discover and proclaim the capability of North Carolina to supply the wants of mankind. Possessed of a fluent tongue and a ready pen, he spread the fame of his State wherever science is cultivated.

This short notice of an early and active member of the Mitchell Society, who looked with interest on its work as promising much good and much honor to North Carolina, is to be regarded as but preliminary to a more extended account of the life, character and labors of one who was at all times a faithful servant of the public, "diligent in business, fervent in spirit, serving the Lord."

A SKETCH OF THE BOTANICAL WORK OF THE REV. MOSES ASHLEY CURTIS, D. D.

READ BEFORE THE MITCHELL SOCIETY AT THE UNIVERSITY OF NORTH
CAROLINA, MAY 22D, 1885, BY THOMAS F. WOOD.

In the early days of this century botany was the science of great expectations in America. The florid narratives of the old chroniclers were being displaced by a generation of scientific men, whose zeal and earnestness fitted them for the vast work of the exploration and study of the flora of a new continent.

From the very beginning in this country, the science of botany was an aristocracy of learning, except in the matter of lineal transmission, and even in this direction we have two illustrious examples in the case of the Bartrams and Michaux. The pioneer teachers were admitted authority in their broad domain, and received the encouragement and patronage of the mother country in our colonial state, and the sympathy and respectful admiration of the people when we became federated States. This was a very natural state of things, for although the science of botany was so well cultivated that it became a matter of national pride, still the real botanists were very few.

As we look through the superb volumes which remain the permanent monuments of the work of these men, we find a striking repetition of a very few names referred to as authority, but these men were able, industrious, and with very few exceptions, men of marked longevity, having the capacity of exciting enthusiasm among the young men who attended their instruction. It was not until the century was nearly twenty years old that botanical works began to multiply in such numbers as to be of use to the student; so at the time Dr.

Curtis entered upon the study of botany, the science had already enlisted the men who were to give it the permanent impress of their rare ability. I propose now to pass in review the botanical career of the Rev. Dr. Curtis, rather than attempt a general biography.

Moses Ashley Curtis was born in Stockbridge, Berkshire county, Mass., May 11th, 1808. His mother was the daughter of Gen. Moses Ashley. He graduated at Williams College, September, 1827.

Mr. Curtis came to Wilmington in October, 1830, as a tutor in the family of Governor Dudley. He devoted himself in all of his leisure hours to the study of the flora of that region. Especially on Saturdays he made excursions among the sand hills and savannahs near Wilmington. At that time (1831) Wilmington was a village of about 4,000 inhabitants, and the field for botanizing existed where now are busy streets. Close up to the village reached the pine forests abounding with a flora rich and novel to the enthusiastic young botanist, while the savannahs, with their strange and interesting *Sarracenia* and *Pixidanthera*, and *Droseras*, and the thousands of gaudy heads of *Liatris*, and the brilliant yellows of *Coreopsis* and *Solidago*, charmed the eye and filled his portfolios.

A flora so vast as that of America was difficult for any one man to compass in the course of a lifetime, and so the earlier botanists had conceived the advantage of florulas, to be prepared each for his local section. Dr. Samuel L. Mitchell led off in 1807 in this work by publishing a catalogue of the plants growing around his country seat in New York, and he was followed by Maj. John le Conte in a florula for the island of New York in 1811, and in 1814 Dr. Jacob Bigelow published a model specimen of a local flora entitled *Florula Bostoniensis*. Subsequently the science of botany was enriched by the contributions of Dr. J. A. Brereton, for Washington, D. C.; and in 1830 by Prof. C. W. Short, for Lexington, Ky.

It was the result of his botanical studies that Mr. Curtis gave to the public under the title of "*Enumeration of Plants Growing Spontaneously Around Wilmington, North Carolina*," with remarks on some new obscure species." This first appeared in the *Boston Journal of Natural History*, September 3d, 1834, (No. 2, vol. 1,) the first edition of which was nearly all burnt, but it was subsequently reprinted "with many additions and emendations." Dr. Gray says it was one of the first works of the kind in this country in which the names are accented.

His quick eye and assiduous application may be judged by the fact that* in little more than two seasons, at intervals from other

* Enumeration of Plants, &c., M. A. Curtis, p. 83. Reprint Boston Journal Natural History, Vol. 1, No. 2, 1834.

engagements, he made a collection of over a thousand species (exactly 1,031.) This was two hundred less than were then reckoned as belonging to the flora of Massachusetts, and more than half the number described in Elliott's Botany of South Carolina and Georgia, and about a fourth of the phenogamous flora of the United States, as then known. He then adds that much ground still remains unexamined. Most of these plants were found within about two miles radius of Wilmington, and a number of maritime species discovered at Smithville, and several from Rocky Point. Dr. Darlington, who was one of his earliest and warmest friends, speaks of Mr. Curtis at that date as a careful observer and sagacious botanist.

At the time Mr. Curtis was pursuing his studies in Wilmington, there were few professed botanists in the State. The year before Dr. Curtis published his florula (1833),* H. B. Croom, Esq., and Dr. H. Loomis made a pretty careful survey of Newbern, and printed a catalogue of the plants they found growing in that neighborhood. Subsequently (1837) Mr. Croom published an enlarged catalogue. Mr. Croom was a lawyer, and a botanist of no mean ability, and besides the above contributions, prepared a valuable monograph on the Sarracenias which appeared in the third volume of the Annals of the New York Lyceum. The memory of Mr. Croom received a more distinguished record in the annals of botanic science than any of his contemporaries or successors in North Carolina, having had a genus (*Croomia*) named in honor of his contributions.

In a recent contribution the *Botanical Gazette*, (April, 1885,) Dr. A. W. Chapman, author of the *Flora of the Southern States*, says:

"Fifty years ago, on one of those calm, hazy October evenings, peculiar to the climate of Florida, the quiet of the pleasant town of Quincy was interrupted by the rapid approach of a carriage with attendant outriders, which, having made part of the circuit of the public square, drew up before my office, and a gentleman of middle age, spare habit, light hair and blue eyes, came forth and introduced himself as Mr. Croom, of North Carolina. This was the commencement of my brief intercourse with Hardy B. Croom, the discoverer of *Torreya*; for as is well remembered, a year afterwards he was lost at sea, with all of his family, on the passage from New York to Charleston. Of his personal traits, it is needless here to say more than that he belonged to that class of wealthy and intelligent Southern gentlemen whose homes, renowned for their unostentatious hospitality, were the abode of all that is most charming in the

* Dr. Curtis gives the date of his publication as 1833, but in the reprint I have, it is stated that the paper was communicated to the Boston Journal of Natural History in 1834.

refinements of domestic life: but which now, by impoverishment, resulting from disastrous civil conflict, and consequent change of social customs and duties, and by the invasion of rude manners and looser ethics, have entirely disappeared. * * * Mr. Croom was then on one of his annual journeys from Newbern, N. C., the residence of the family, to his plantation in the adjoining county of Leon; but previously to settling in that county, he had rented a plantation on the west bank of the Apalachicola river, opposite the calcareous cliffs at Aspolaga, on the east bank, which at that time were covered by a dense grove of *Torreya*, and it was here probably in 1833 that he first saw it."

This glimpse of Dr. Curtis' contemporary is one of the very few I have seen, and hence its insertion here.

In Wilmington Dr. James F. McRee, Sr., also cultivated botany with assiduity, and the two botanists worked together effectively. Dr. McRee's country residence was at Hilton, the country seat of Cornelius Harnett, near the junction of the North East Cape Fear with the main stream. It was at this house that Harnett received a visit from Josiah Quincy, and where plans were laid for the prosecution of active hostilities against Great Britain. Here Dr. McRee cultivated with great care and with rare success the indigenous trees and shrubs he collected in the course of his extensive journeys in the pursuit of his calling. Dr. McRee added 34 species to Curtis' catalogue, annotated by him, besides several which were printed in the catalogue proper, and all through the writings of Dr. Curtis may be found appreciative allusions to his scientific attainments. No proper memorial has ever been made of this pioneer scientist.

Before railroads brought their freights speedily to our doors, and the art of printing had so multiplied books, there could be found upon the shelves of Dr. McRee's library the most recent and expensive works on the science of medicine in which he was a great master, but side by side with them he had a natural history collection in volumes of such rare value that to-day—the day of numerous and valuable books—it would be considered exceedingly choice. Until a late day in his life his herbarium was kept in order by replacing new specimens, but as his health failed and the war brought sorrows and cares to his home, his herbarium fell into neglect, and finding no cultured hand to preserve its scientific treasures, it was abandoned, and its crumbling remains now lie neglected in the dusty garret of a former slave, and the best of the books doubtless found their way through the intervention of plunderers, to Northern book-stalls, if they did not go down off Cape Fear in the ill fated steamer *Gen. Lyons*, with thousands of dollars belonging to others of our citizens.

Prof. Elisha Mitchell and Rev. Dr. L. De Schweinitz had preceded Dr. Curtis in the study of North Carolina plants, the former to abandon it for the more congenial study of geology, the latter to establish a world-wide reputation.

Dr. Cyrus L. Hunter, of Lincoln county, published a list of such plants as he found in his neighborhood, about the year 1834, and pursued his studies with more or less regularity and zeal since then.

This scanty review gives an idea of what degree of cultivation the pursuit of botany had reached in North Carolina when Mr. Curtis engaged in it.

To the south of us the Rev. Dr. Bachman, a diligent naturalist, had made such advance in the study of botany as to publish a catalogue of the plants growing in the vicinity of Charleston. At the same time, Mr. H. W. Ravenel was also a cultivator of the science. Of both of these gentlemen Mr. Curtis speaks in his diary as having met, while on a botanical tour in South Carolina and Georgia in 1835, also Mr. Leitner, of Georgia.

The number of botanists actually at work were few in number, but those were bound together by the closest ties of scientific and friendly interests. Much of the knowledge of plants was communicated by means of long and carefully prepared letters, written with that engaging art which unfortunately threatens to become extinct.

Mr. Curtis was twenty-two years old when he came to Wilmington a young teacher. His early associations had been favorable for the inculcation of a true scientific spirit. He found absorbing pleasure in the quiet of the fields and forests, and without ever a thought of becoming a scientific botanist, he amassed a wealth of knowledge, and won an exalted position among the botanists of the world. No doubt he looked forward to Saturday with eager expectation, that he might exchange the constrained duties of the school room for the freedom of the woods, and for pleasant intercourse with the old and new floral friends he was to meet.

If there is such a thing as a scientific instinct, Mr. Curtis possessed it. He was habitually accurate in his studies, and the results were early relied upon by his correspondents. Coming into a new field of botanical study, it was quite natural that he should have directed his attention to the habits of the very local *Dionaea muscipula*. Saturday after Saturday he would visit the savannahs, and lying at length upon the ground, would watch its peculiarities. The popular description which he gave of it in "Enumeration of Plants around Wilmington," has been repeated for the last fifty years, and

shows how greatly he possessed the gift of accurate and entertaining description. I quote the passage without apology:

"The leaf, which is the only curious part, springs from the root, spreading upon the ground or at a little elevation above it. It is composed of a petiole or stem with broad margins, like the leaf of an orange tree, two to four inches long, which at the end suddenly expands into a thick and somewhat rigid leaf, the two sides of which are semicircular, about two-thirds of an inch across, and fringed around their edges with somewhat rigid cilia or long hairs like eye lashes. It is very aptly compared to two upper eyelids joined at their bases. Each side of the leaf is a little concave on the inner side, where are placed three delicate, hair-like organs in such an order that an insect can hardly traverse it without interfering with one of them, when the two sides suddenly collapse and enclose the prey with a force surpassing an insect's efforts to escape. The fringe or hairs of the opposite sides of the leaf interlace, like the fingers of the two hands clasped together. The sensitiveness resides only in these hair-like processes on the inside, as the leaf may be touched or pressed in any other part without sensible effects.

"The little prisoner is not crushed and suddenly destroyed, as is sometimes supposed, for I have often liberated captive flies and spiders which sped away as fast as fear or joy could hasten them. At other times I have found them enveloped in a fluid of a mucilaginous consistence, which seems to act as a solvent, the insects being more or less consumed in it. This circumstance has suggested the possibility of their being made subservient to the nourishment of the plant through an apparatus of absorbent vessels in the leaves. But as I have not examined sufficiently to pronounce on the universality of this result, it will require further observation and experiment on the spot to ascertain its nature and importance. It is not to be supposed, however, that such food is necessary to the existence of the plant, but like compost, may increase its growth and vigor.

"But however obscure and uncertain may be the final purpose of such a singular organization, if it were a problem to construct a plant with reference to entrapping insects, I cannot conceive of a form and organization better adapted to secure that end than are found in the *Dionœa muscipula*. I therefore deem it no credulous inference that its leaves are constructed for that specific object, whether insects subserve the purpose of nourishment to the plant or not. It is no objection to this view that they are subject to blind accident, and sometimes close upon straws as well as insects. It would be a curious vegetable indeed, that had a faculty of distinguishing bodies, and recoiled at the touch of one, while it quietly submitted to violence from another. Such capricious sensitiveness is not a property of the vegetable kingdom.

"The spiders net is spread to ensnare flies, yet it catches whatever falls upon it; and the ant lion is roused from his hiding place by the fall of a pebble; so much are insects, also, subject to the blindness of accident. Therefore the web of the one and the pitfall of the other are not designed to catch insects! Nor is it in point to refer to other plants of entirely different structure and habit which sometimes entangle and imprison insects. As well might we reason

against a spider's web because a fly is drowned in a honey pot, or against a steel trap, because some poor animal has lost its life in a cider barrel."

"In his note upon the structure of *Dionæa*, or Venus Fly-Trap, a plant found only in the district around Wilmington," says Dr. Asa Gray. "Dr. Curtis corrected the account of the mode of its wonderful action that had prevailed since the time of Linnæus, and confirmed the statement and inferences of the first scientific describer, Ellis, namely, that his plant not only captures insects, but consumes them, enveloping them in a mucilaginous fluid which appears to act as a solvent."

During the preparation of his first little work he returned to Boston and commenced his studies for the ministry, 1833-'34, with the Rev. William Croswell. While there he commenced a correspondence with Dr. Torrey, who aided him in determining species. His acquaintance with Dr. Gray commenced later, but became much more intimate.

While on his way to Boston, he formed the acquaintance of Dr. Darlington, of Westchester, Pa., and he afterwards became a valued friend and a helper so long as he needed one.

He married Miss Mary DeRosset, daughter of the elder Dr. A. J. DeRosset, of Wilmington December 3d, 1834.

He returned to the South in the latter part of 1834, continued his studies with the Rev. Dr. R. B. Drane, and was ordained to the ministry of the Episcopal church by Bishop Moore, of Virginia, in 1835. He immediately entered upon mission work in Western North Carolina from Charlotte to the mountain country as far as Morganton, with his residence in Lincolnton. It was while pursuing his work as a missionary that he took advantage of his journeying in the solitary woods to pursue his botanical researches. Most of his traveling was done in a "sulky," which was so arranged that his portfolio was under the cushion. As he came across specimens by the way, he would collect them and place them in his portfolio, and so by the end of his journey he had secured a number of ready pressed plants for future study, or for mounting permanently in his herbarium. He left the mountain section at the end of 1836, and was engaged as a teacher in the Episcopal school in Raleigh from the beginning of 1837 to May 1839.

The summer of 1839 he spent in the mountain country for health chiefly, though always carrying on his botanical explorations, and went through that region to the extreme west and southwest of the State.

Extending his botanical observations to the western borders of his adopted State, Dr. Curtis was among the first to retrace the steps and rediscover the plants found and published by the Elder Michaux, in the higher Alleghany mountains." (Silliman's Jour., January to June, 1873, p. 392.) From the very beginning of these journeys the search for a plant found in the Elder Michaux's herbarium was begun and pursued with hopeful expectation for years. Michaux had been proven so truthful and accurate in his descriptions, that he had impressed his successors with faith in him. This veteran botanist had collected a remarkable plant, as Dr. Gray says, with the habit of *Pyrola* and the foliage of *Galax*, and the only specimen extant was in the Michauxian herbarium, among the *Planta incognita*, and this only in fruit. This plant, since discovered in flower by Mr. Hyams in McDowell, had already been named by Dr. Gray, in honor of Prof. Short, of Kentucky, and now known as *Shortia galicifolia*. Over and over again did Dr. Curtis traverse the line of Michaux's travel for *Shortia*, but without success.

Prof. Gray* says in a paper in which he sketched the botanical tours of the botanists who had visited the mountains of North Carolina in 1841: "No living botanist is so well acquainted with the vegetation of the Southern Alleghany Mountains, or has explored those of North Carolina so extensively as the Rev. Mr. M. A. Curtis, who, when resident for a short time in their vicinity, visited, as opportunity occurred, Table Mountain, Grandfather, the Yellow Mountain, the Roan, the Black Mountain, &c., and subsequently, (although prevented by infirm health from making large collections) extended his researches through the counties of Haywood, Macon, and Cherokee, which form the narrow southwestern extremity of North Carolina. To him we are indebted for local information, which greatly facilitated our recent journey, and, indeed, for a complete itinerarium of the region south of Ashe county."

Early in 1840 he was called to mission work about Washington, in Beaufort county, remaining there a year, and early in 1841 he removed to Hillsborough, where he remained six years. In April, 1847, he removed to Society Hill, in South Carolina, which accounts for the fact that he is spoken of as a resident there, his residence at that place having been nine years. From Society Hill Dr. Curtis removed to Hillsborough in 1856, and resided there until his death in 1872.

*Notes on a Botanical Excursion to the Mountains of North Carolina, &c. Am. Journal Sc., Oct., Dec., 1841, p. 12.

As it is the design of this paper to speak more particularly of Dr. Curtis as a botanist, it will be observed by many of his old friends who knew of his labors in his Divine calling—how self-sacrificing they were, how full of human sympathy, how devoid of self-seeking—that I must leave this part of his life to those abler to record the victories he won for the Cross.

The first botanical essay contributed by Dr. Curtis was more than a mere catalogue, and it attracted the favorable notice of his teachers and correspondents. It was so thorough that after a lapse of half a century only about fifty species have been added to his list. One of them has a peculiar interest as illustrating the laudable jealousy with which he regarded his earlier achievements.

In the summer of 1867, Mr. Wm. M. Canby, of Wilmington, Del., an esteemed friend of Dr. Curtis, a botanist second to none in the Union for diagnostic learning, came to Wilmington to add to his collection, and look over the old botanizing territory after the smoke of war had cleared up. On the memorable occasion of this narrative he had been to Hilton Ferry, close by the estate of Dr. James F. McRee, in search of the very local Alligator Bonnets, (*Nuphar Sagittæfolium*.) He had completed his collection, and was carefully spreading them on the logs to dry. His face was turned towards the bank of the river, which at this point is an abrupt bank of grey marl, overhung by thick festoons of beautiful shrubbery. Clinging to this wall, under the drippings of the water through the marl as the tide recedes, he espied beautiful fronds of the true Maiden's Hair Fern, (*Adiantum Capillus-Veneris*.) This beautiful fern had not before been detected in this part of the State, or indeed north of Alabama. The discovery was a great pleasure and surprise to Mr. Canby, for here on the territory of Curtis he had been able to add such a beautiful plant to his list. Specimens were soon borne by the mail to Dr. Curtis, then living in Hillsborough, and the earliest mail brought me a letter of specific instructions where to go and what to look for, and I was able to verify Mr. Canby's discovery. It was not long before Dr. Curtis had important business to attend to in Wilmington, and a visit to the newly discovered *Adiantum* station was not the least important.

Dr. Curtis' method as a student was that of broad-minded scientist. Just to name a flower and preserve it carefully in his herbarium was to him but the beginning of his work. His earliest records show that he studied the relation of plant-life to geologic and climatic surroundings. The study of botanical geography was begun and continued during his whole career as a botanist, extend-

ing over 38 years. The account he has given us in his "WOODY PLANTS," is to-day the best guide to the natural climatological divisions of the State which has ever been given. His studies were also directed to the numerous economic questions which met him in his intimate acquaintance with the treasures of the field and forest. It was this feature of his labors alone which brought him an audience in his adopted State, and with this object in view he brought together the material which he published as a part of the Geological and Natural History Survey, known best by the condensed title given to it by Prof. Emmons, as the "*Woody Plants*." This volume of 124 pages was printed by the State in 1860, and at once became a popular manual for the farmer and the woodsman, and for amateur botanists, a key to the more conspicuous trees and shrubs useful for their fruit or timber, or as ornaments. The key devised to enable one of no botanical knowledge to determine a given plant or shrub was founded upon the character of the fruit, and distinguished by their common name. The preface of this little work is an introduction to the geographical distribution of plants in the State, and shows what a thorough acquaintance he had with the vast subject. This short essay attracted the attention of the whole country to the unique position which our State holds in respect to climate, soil and forest products. That North Carolina has a difference of elevation between the east and west which gives a difference of climate equal to 10 or 12 degrees of latitude, was first shown by Dr. Curtis in his comparison of the local flora in his *Woody Plants*. He made himself acquainted at the very outset of his work as a botanist with the labors of the earlier explorers of the State. In his "Plants around Wilmington," we find him quoting from Brickell's Natural History of North Carolina, and Catesby's Natural History of Carolina. The sketch he gives of the progress of botanical discoveries in the State in his *Woody Plants* is full of interest, and shows how deeply he caught the inspiration from their example of self-denial in the cause of science.

In "*Woody Plants*" is displayed, as in the succeeding works written by him, an accurate knowledge of the common names of plants—a subject full of confusion—misleading young botanists and bewildering the old ones. As though the change from one system to another were not enough, then to add to this the formidable confusion of synonyms (with no guide to its mysteries like Watson's,) and then the local names of plants, it is confusion interminable. In this study, though, Dr. Curtis had a cultivated philological turn.

Scarcely a common name escaped him, as various as they were in all the numerous localities.

Since Woody Plants was issued, it has been made the basis of several publications, and we fear without proper authorization. The report on Forestry by Hough, prepared for the general government, has quoted voluminously from Curtis, and since then a volume bearing on its covers the modest title of Woods and Timbers of North Carolina only reveals its true character after we pass the new title page. I am sure, though, that the author would have been delighted when he was preparing his little volume for the press with so much labor and such rare knowledge as a free offering to his adopted State, if he could have known that it would have been so largely read and appreciated by those for whom he originally intended it.

As great a task as the collection of the Phanogamous Plants was, Dr. Curtis had fully completed it before his Woody Plants was published. Of course, exception is here made to a small number of plants discovered since chiefly by Mr. W. M. Canby, Mr. Hyams, Mr. McCarthy, Maj. Young, and myself. Early in his career he undertook the study of the fungi. This very difficult branch of botany at that time had few votaries, and the unexplored field was immense. There was no book that could be considered a text-book on the subject published in America. The Rev. L. D. de Schweinitz had made two contributions to the fungi of America, one in 1820, published in Leipsic, and entitled "*Fungi Carolinae Superioris*," the other a "*Synopsis Fungorum in America Boreali media degentium*," published in the Transactions of the American Philosophical Society in 1831. With these guides to local species, our enthusiastic student addressed himself to his labor of love.

In 1846 he commenced a correspondence with Mr. H. W. Ravenel, of South Carolina, a correspondence which was continued until Dr. Curtis' death in 1872. Mr. Ravenel was then, as he is now, a devoted student of the fungi, having made large collections. His position now among American botanists is that of very high authority on the subject.

About two years after Dr. Curtis began his correspondence with Mr. Ravenel, he also commenced a correspondence with the Rev. M. J. Berkley, of England. Mr. Berkley became greatly attached to Dr. Curtis by reason of the ardor and accuracy with which he pursued the investigation of new species. De Schweinitz had him-

self discovered over 1200 species, chiefly in this State, but the field was still far from being exhausted. Correspondence between these gentlemen continued for a number of years, and a scientific copartnership was formed which resulted in the addition of nearly five hundred new species to the list up to the year 1867, and since Dr. Curtis' death a number of new species appeared in "Grevillia" under the joint authorship of Berkley and Curtis.

Correspondence between botanists at that time was very active, and the letters which were interchanged comprised the principle stock of knowledge then available. The letters which have been preserved are very instructive, even at this date. Not only do we find in them the growth of botanical science, but such notes about the state of civilization as to roads, forests, dwellings, farms, taverns, and the social condition of the people, which make them treasure houses for the general historian. The correspondence between John Bartram, and Collinson, Humphrey Marshall, Ellis, Benj. Franklin, and other notables of the day, with an editorial by Dr. Darlington, is one of the few volumes which have preserved letters in a printed form, and few volumes give a more satisfactory insight into the state of our social affairs than this one. It is not a complete panorama, but the passing allusions to what these itinerant botanists saw, gives a keen relish to their work. It is to be regretted that such a small part of this correspondence is preserved, for like that of McRee and Curtis, much of it is long since inaccessible.

En passant it is interesting to observe how little notice these pioneers of science took of the current of political affairs. For although the travels of Wm. Bartram through the Carolinas and Georgia were made during the war of the Revolution, our zealous botanist has no ear for the war-like preparations which must have resounded in the air, but was totally absorbed in what Nature had so lavishly spread out before him. For him no triumph was equal to the discovery of a new plant, the solution of the mysteries of the habits of birds and insects. Like all of his sect, the Friends, Bartram had the strictest bias against the commotion of war, and this, added to love of the knowledge of nature, may account for his silence.

But to return from this digression. Dr. Curtis found this new field of botany greatly to his liking. His habit of study was painstaking and accurate, and the microscopic work necessary for the determination of species became in his hands a triumph of skill. It was in this steady sedentary pursuit that Dr. Curtis injured his health. For hours at a time, day by day, he pored over the micro-

metry of fungus spores. Few were the botanists with whom he could compare specimens and interchange notes. He pursued this specialty without the stimulus offered now by special societies, and for the greater part of his career absolutely without an audience. It is certain, therefore, that nothing but the intensest love of his studies led him up to the highest station occupied by any American botanist. I have heard him say, "Nothing surprised me more than to be called a botanist at first. Although I had accomplished the survey of the phenogamous plants of the State, I still felt that I was comparatively not a botanist." But this modesty was habitual with him. It was a modesty, however, not begotten of uncertainty, for in all his work Dr. Curtis was accurate. If he spoke at all it was always with the authority of the master.

Shortly after Dr. Hawks' History of North Carolina appeared, Dr. Curtis published in the University Magazine, (1860), "*A Commentary on the Natural History of Dr. Hawks' History of North Carolina.*" This paper demonstrated the thorough knowledge Dr. Curtis had obtained of the botany of the old travelers and explorers. Dr. Hawks had drawn with too free a hand the wonders of our truly wonderful forests and fields, and had been led away quite unconsciously by the florid accounts of Harriot, and Amadas & Barlowe, and Lawson. The analysis which Dr. Curtis made left but little of the fabulous statement of the early chroniclers disproved, and proved Dr. Hawks to have been but slightly informed about natural history. This paper is an almost complete key to Lawson's History, as far as the natural history items are concerned, although it is not a continuous narrative. The circulation which the University Magazine had at the time was not large enough to overtake the natural history errors of Hawks' History, and many of them are extant to this day as traditions among the common people.

It was during the war 1861—1865, that Dr. Curtis conceived the idea of preparing a work on the *Edible Fungi*. The events which led up to this scientific essay, it may be well to narrate. Although he was well acquainted botanically with fungi, he was not an avowed mycophagist until somewhere about 1855. Before this he expressed himself to Mr. Berkeley as being afraid of them, as he had grown up with the common prejudices against them entertained by most people in this country. Having occasionally read of fearful accidents from their use, and there being abundance of other and wholesome food obtainable, he felt no inclination to run any risks in needlessly enlarging his bill of fare, and so he passed middle life without having once even tasted a mushroom. But as his confidence

increased, under the guidance and assistance of Mr. Berkeley, a confidence to discriminate species grew up with it, and a curiosity to test the qualities of these much-lauded articles got the better of timidity, and at the time he wrote (1869) he could safely say that he had eaten a greater variety of mushrooms than any one on the American continent. He introduced several species before untried and unknown. From the beginning of his experiments he exercised great caution even with the species long recognized as safe and wholesome. In every case he began only with a single mouthful. No ill effect following, he made a second essay upon two or three mouthfuls, and so on gradually until he made a full meal of them.

Fortunately he did not blunder upon any kind that was mischievous, although he ate freely of forty species. This, he says, was due to the fact that his general acquaintance with species which have been long used in Europe, and his experiments were only with species bearing some affinity or analogy to them.

Mycophagy was an art and a science with Dr. Curtis, and in a letter to Mr. Berkeley he thus describes some of his experiences:

“Of the *Merisma* group of Polypores, having already tried *P. frondosus*, *confluens*, and *sulphureus*, I ventured, after some hesitation, and with more than usual caution, to test the virtues of the new American species, (*P. Berkeleyi*, Fr.,) notwithstanding the intense pungency of the raw material, which bites as fiercely as *Lactarius piperatus*. When young, and before the pores are visible, the substance is quite crisp and brittle, and in this state I have eaten it with impunity and with satisfaction, its pungency being all dissipated by stewing. I do not, however, deem it comparable with *P. confluens*, which is rather a favorite with me, as it is with some others to whom I have introduced it. *P. sulphureus* is just tolerable; safe, but not to be coveted when one can get better.

“When I say safe, I mean not poisonous. I cannot recommend it as a diet for weak stomachs, which should be said of some other fungi of similar texture. I am here reminded of an experience I had three or four years ago with this species, which would have greatly alarmed me had it happened at an early date in my experiments, and which would probably have deterred any one unused to this kind of diet from ever indulging in it again. I had a sumptuous dish of it on my supper table, of which most of my family, as well as a guest staying with us, partook very freely. During the night I became very sick, and was not relieved until relieved of my supper. My first thought on the accession of the illness was of *Polyporus sulphureus*; but as I remembered that inflammation was one of the symptoms of fungus poisoning, and I could detect no indications of this in my case, I soon dismissed the rising fear, did not send for the doctor, nor take any remedy. Others who had partaken of the fungus more freely than myself, were not at all affected; and I presume my sickness was no more induced by the *Polyporus* than by the bread and butter I had eaten. And yet

had I alone partaken of the dish, or had one or two others been affected in like manner, doubtless the night attack would have been very confidently attributed by some to the mushroom; or had this been my first trial of that article, possibly I might ever after have regarded it with suspicion. I learned a few days afterwards, from one of our physicians, that this kind of sickness was then somewhat prevalent in the community, and could be attributed to no known cause. For the credit of this species, therefore, we were fortunately able to distinguish the *post hoc* from the *propter hoc*.

There are families in America that for generations have freely and annually eaten mushrooms, preserving a habit brought from Europe by their ancestors. In no case have I heard of an accident among them. I have known no instance of mushroom-poisoning in this country, except where the victim rashly ventured upon the experiment without knowing one species from another. Among the families above mentioned, I have not met with any whose knowledge of mushrooms extended beyond the common species (*A. campestris*) called Pink Gill in this country. Several such families live near me, but not one of them was aware, until I informed them, that there are other edible kinds. Everything but the Pink Gill, which had the form of a mushroom, was to them a toadstool, and poisonous. When I first sent my son with a fine basket of imperials (*A. cæsaræus*) to an intelligent physician, who was extravagantly fond of the common mushroom, the lad was greeted with the indignant exclamation, "Boy, I wouldn't eat one of those things to save your father's head!" When told they were eaten at my table, he accepted them, ate them, and has eaten many a one since with all safety and with no little relish. Since that time our mycophagists eat whatever I send them without fear or suspicion.

"I have interested myself to extend the knowledge of these things among the lovers of mushrooms, and also their use among those who have not before tried them. In the latter work I am not always successful, on account of a strong prejudice against vegetables with such contemptuous names, and an unconquerable fear of accidents. Yet, as in my own case, curiosity often conquers these errors. When away from home I have frequently obtained ready permission from a kind hostess to have cooked a dish of mushrooms that I had found on her premises. It has rarely occurred in such cases that the dish, then tasted for the first time, was not declared to be delicious, or the best thing ever put in the mouth. This latter phrase was once used in reference to so indifferent an article as *A. salignus*. Indeed, I have found several persons who class this among the most palatable species. To such persons, a dish of fresh mushrooms need seldom be wanting, as this one can be had every month of the year in this latitude. I am induced to believe that the quality of this species varies with the kind of wood it grows from, and that it is better flavored when gathered from the mulberry, and especially from the hickory, than when taken from most other trees. Its fitness for the table seems also to depend much upon the rapidity of its growth; those which grow slowly, as is the case with some of our garden vegetables, being of tougher texture and of less delicate flavor. A warm sun, after heavy rains, brings them out in greatest perfection.

"I have several times been asked by persons eating mushrooms for the first time, whether these things belong to the vegetable or animal kingdom. There is certainly a very noticeable resemblance in the flavor of some of them to that of flesh, fish, or mollusc, so that the question, as founded merely on taste, is not an unnatural one. But I was much struck with the propriety when reading an article in "Fraser's Magazine" a few years since, written by the late Mr. Broderip, who therein says that mushrooms contain osmazome. If this be so, it accounts both for their flavor and for their value as food. Of this latter quality I had become so well convinced that, during our late war I sometimes averred, and I doubt if there was much, if any, exaggeration in the assertion, that in some parts of the country I could maintain a regiment of soldiers five months of the year upon mushrooms alone.

"This leads to a remark which should not be overlooked, upon the great abundance of eatable mushrooms in the United States. I think it is Dr. Radham who boasts of their unusual number in Great Britain, stating that there are 30 edible species in that kingdom. I cannot help thinking that this is an under estimate. But if the doctor is correct, there is no comparison between the number in your country and this. I have collected and eaten 40 species found within two miles of my house. There are some others within this limit which I have not yet eaten. In the catalogue of the plants of North Carolina, you will notice that I have indicated one hundred and eleven species of edible fungi known to inhabit this State. I have no doubt there are 40 or 50 more, as the alpine portion of the State, which is very extensive and varied, has been very little explored in search of fungi.

"In October, 1866, while on the Cumberland mountains in Tennessee, a plateau less than 1,000 feet above the valleys below, although with little leisure for examination during the two days spent there, I counted eighteen species of edible fungi. Of the four or five species which I collected there for the table, all who partook of them, none of whom had before eaten mushrooms, declared them most emphatically delicious. On my return homeward, while stopping for a few hours at a station in Virginia, I gathered eight good species within a few hundred yards of the depot. And so it seems to be throughout the country. Hill and plain, mountain and valley, woods, fields, and pastures, swarm with a profusion of good nutritious fungi, which are allowed to decay where they spring up, because people do not know how or are afraid to use them. By those of us who know their use, their value was appreciated as never before during our late war, when other food, especially meat, was scarce and dear. Then such persons as I have heard express a preference for mushrooms over meat, had generally no need to lack grateful food, as it was easily had for the gathering, and within easy distance of their homes, if living in the country. Such was not always the case, however. I remember on one occasion during the gloomy period, when there had been a protracted drought, and fleshy fungi were to be found only in damp shaded woods, and but few were there, I was unable to find enough of any one species for a meal; so gathering of every kind, I brought home 13 different kinds, had them all cooked together in one grand *pot pourri*,

and made an excellent supper. Among these was the Chautarelle, upon which I would say a few words in confirmation of what I have already said upon the varying qualities of mushrooms in different regions and localities. You have somewhere written of this mushroom as being so highly esteemed a delicacy, that it is much sought for when a dinner of state is given in London. Can this be because it is a rarity? (for nothing common and easily obtained is deemed a delicacy, I believe), or because you have it of finer flavor in England? Here, where it abounds, no one seems to care at all for it, and some would forego mushrooms entirely rather than eat this. It certainly varies much in quality, as I have occasionally found it quite palatable, and again, though cooked in the same mode, very indifferent. I have been unable to ascertain whether this difference is due to locality, exposure, shade, soil, moisture, or temperature. That soil has much to do with the flavor of some mushrooms I am well convinced. In a parcel of Pink Gills I have sometimes found one or two specimens, though perfectly sound, of such unpleasant odor and taste as would spoil a whole dish. So also with the Snow Ball, (*A. arvensis*), of which I annually find a few beautiful specimens growing near my residence, upon a grassy turf which covers a pile of trash made up of decomposed sticks, leaves and scrapings from the adjoining soil. Their taste and odor are perfectly detestable. I had one specimen cooked, but no amount of seasoning could abate the offensiveness of the odious thing; yet within 100 yards of these I gather specimens of the same identical species, which are of fine flavor, equal to that of the best mushrooms. As I have before intimated, the varying flavor of mushrooms growing on different kinds of wood, so here I suppose the unpleasant qualities of some specimens of these two well known and favorite species may be owing to something in the soil where they grow which they cannot assimilate, and so render a palatable and wholesome species totally unfit for the table. Whether such specimens, if eaten, would be poisonous or unwholesome, I do not feel any temptation to prove. It is not probable that they will ever do any mischief, for it is incredible that any human being should so pervert his instincts as to swallow such a villainous concoction.

"Experience and observation like these would perhaps justify the inference that an innocent species may sometimes be deleterious, on account of its taking up some bad element from the soil. But as I have never known a case of poisoning in families that are well acquainted with the common mushroom or Pink Gill, that gather the specimens for themselves and have used this article of food annually for many generations I cannot agree with an objection somewhere made by you, that perhaps all mushrooms contain a poisonous element, but some of them in such small quantity as to have no appreciable effect. Now, had you seen the quantities of stewed mushrooms swallowed at a single meal which I have seen thus devoured, and with no more harm than from the same amount of oyster or turtle soup, I think you would be forced to the conclusion that such an amount, even of poisonous infinitesimals, must have had some very unpleasant manifestations, or else be a very innocent diet."

It would seem that our rigidly scientific botanist did not disdain the subtle arts of the gastronomist. For example, in this letter to the Rev. Mr. Berkeley, from which I have already made a lengthy extract, he says, "The *Lycoperdon giganteum* is also a great favorite with me, as indeed, with all my acquaintances who have tried it. It has not the high aroma of some others, but it has a delicacy of flavor that makes it superior to any omelette I have ever eaten. It seems, furthermore, to be so digestible as to adapt it to the most delicate stomachs. This is the Southdown of mushrooms."

Could gastronomic enthusiasm run higher than to compare a devil's snuff box, that the school boy takes particular delight in using as a foot ball to show his detestation, to the luscious meat of a Southdown mutton! And then triumphantly he adds, in this latitude (about 36°) we can find good mushrooms for the table nine or ten months of the year, and some even the year round, and one sometimes emerging from the soil frozen solid!

Dr. Curtis' neighbors shared largely his gastronomic pleasures. It was his custom to send baskets of the choicest of them to his friends, until the divine art of mycophagy reached a good degree of cultivation, and many of them learned to distinguish for themselves the edible ones. Some members of his family became especially expert in foraging for the table among the mushrooms, and Mr. Chas. J. Curtis, now the Rev. Mr. Curtis, afterwards put his knowledge of the forms of these plants to use, by drawing and coloring specimens to illustrate his father's still unpublished work on the "*Edible Fungi*." This work was designed to popularize the use of mushrooms as an article of food. It was written during the late war, when the subject of food was a matter of daily solicitude to thousands of families. In taking up the pen for this work, Dr. Curtis succeeded admirably in divesting himself of every technicality, and, indeed, of describing minutely about 40 of the 111 species, in language not only easy to be understood, but he really made the subject very enticing. Illustrations and comparisons were occasionally drawn from the numerous foreign authors he had mastered. When the war ended and a publisher was sought for the work on "*Edible Fungi*," little encouragement was given. It now remains in MS.

The subject has never been very popular in the United States, and the students who undertake its study are not numerous, and mycophagists do not abound: the former seek for information in works of English and French authorship, and the latter are content with the authenticity of the trade mark on the cans of Champignons, imported from France.

In 1867, the State published as a part of the Geological and Natural History Survey, "A Catalogue of the Indigenous and Naturalized Plants (of the State,)" by Dr. Curtis. It was intended that this work should have been printed with "Woody Plants," but the outbreak of the war prevented it. At the time of its issue, in 1867, its author stated that it was the most extensive local list of plants ever published in North America, comprising over 4,800 species. It was the first attempt to enumerate the cryptogamous as well as the phenogamous plants made by any botanist in this country, and its appearance was a matter of much scientific congratulation. The volume consisted of 158 pages of catalogue, with no scientific description, but a mere statement of the locality of each plant. This was the result of twenty-five years of botanical study, over a territory of 50,000 square miles. Still he was quite confident in the assertion that few flowering plants would be added to his list, and that the additions which would reward the researches of future observers would be entirely cryptogams.

It has always been a matter of regret that this work of a lifetime should have been given to the public in such a skeleton form, and produced in such a primitive state of the typographer's and book-maker's art. The only reward to the man of science was the consciousness of his thorough work, and the State could well have afforded to have made an ample volume in which he might have recorded the rich treasures of his research for the use of the future student. But it seems that Dr. Curtis was very many years in advance of his time, and the expectation that his broad foundation would have been built upon by his early successors has little prospect of fulfilment.

The part which Dr. Curtis took in the progress of American Botany, was always recognized as important. His correspondence was very extensive, and his herbarium was consulted by botanists with great satisfaction. So largely did Dr. Chapman feel himself indebted to Dr. Curtis for aid, that he dedicated the first edition of his *Flora of the Southern United States* to him, and the two botanists were in close communication until the death of Dr. Curtis in 1872.

"All our associate's work was marked by ability and conscientiousness. With a just appreciation both of the needs of the science and of what he could best do under the circumstances, when he had exhausted the fields in Phænogamous Botany within his reach, he entered upon the inexhaustible ground of Mycology, which had been neglected in this country since the time of Schweinitz. In this difficult department he investigated and published a large

number of new species, as well as determined the old ones, and amassed an ample collection, the preservation of which is most important, comprising, as it does, the specimens, drawings and original notes which are to authenticate his work. By his unremitting and well directed labors, filling the intervals of an honored and faithful professional life, he has richly earned the gratitude of the present and ensuing generations of botanists."

(Am. Jour. of Science. Third series, Vol. V, No. 29, May, 1873.)

During Dr. Curtis' lifetime very little attention had been paid to the life-history of fungi by the medical profession. The theory of contagium vivum was barely foreshadowed by J. K. Mitchell, and afterwards by Salisbury, but so crude was the botany of even these writers, that they made but little impression upon the medical profession, and only excited the mild derision of the real botanists. I well remember upon one occasion when a group of doctors had accidentally met at the office of a brother physician, and were admiring the beautiful microscopic appearance of several fungi, especially the *Oidium albicans*, as figured in the book of the season—Beale on the "*Microscope in Practical Medicine*." This fungus was supposed to stand in relation of a causative agent in *muguet or thrush*. Dr. Curtis came up in the midst of our discussion of the subject, and at once recognized a very familiar fungus and made it very clear to us that fungus spores only found lodgment when the soil was prepared to receive it, and that we must beware of a too hasty conclusion of the disease-carrying properties of the fungi. *Oidium* was found in the mouth of the baby with thrush because there was a condition precedent which favored its lodgment, and so far from being the cause of the disease, it was the result of the disease. His familiarity with the forms, which to doctors who had been four years cut off from medical literature, was truly wonderful, but was a pretty clear statement of the general principles which to-day are held by some of the best thinkers in the medical profession.

I have spoken of Dr. Curtis' splendid achievements, his scientific precision, his ardor in the pursuit of natural history, his completion of a botanical survey almost to the remotest domain of the lowest microscopic plant, but I would not have you believe that this was the sum of his life work. Botanical science was his pastime and recreation. In the mission he had chosen as a servant of Christ, he was no sluggard. He was a pioneer missionary in the rugged hills of North Carolina, when to be a pioneer was to suffer hardship and privation. Love and sympathy beamed from his benignant face, and wherever he went his Master's mission of "Peace on earth

and good will towards men." was made actual by the tenor of his own life.

An intimate friend, Rev. Dr. F. M. Hubbard, who knew him well as a collegian, as a minister of the gospel, as a scientific botanist, thus speaks of him:

The Diocese of North Carolina has suffered a great loss, and the church at large hardly less, in the recent death of the Rev. Dr. Curtis, and his many excellences deserve a larger notice than the customary announcement that one much loved has been called to his reward. His health had been rather feeble for several years, but the end came very suddenly, and was a sad blow to all who knew him. The Rev. Moses Ashley Curtis was a native of Stockbridge, Mass., and graduated at Williams College, in that State, in the class of 1827. Some three or four years after leaving college he removed to Wilmington, North Carolina, where he was married, and in that State the most of his later life was spent. He was ordained by Bishop Ives, and after a brief tour of missionary duty, took charge of St. Matthew's Church, Hillsboro. To this parish, excepting that he was for a few years the Rector of Trinity Church, Society Hill, S. C., the active, clerical service of his life was given. Here, by the great strength, as well as the sweetness of his character, his unwearied labors, his quick and tender sympathies, his high attainments in learning, and warm and steadfast affections, he won from his people, and, indeed, from all who knew him, a love and reverence that were hardly less than devotion. Few men are more earnestly loved while they live, or, when they are called to die, are more sincerely mourned.

By his brethren of the clergy he was no less valued. Indeed, it is no disparagement of the many excellent men of that order in that diocese to say that no one among them was more esteemed and revered by them than was Dr. Curtis. He was a well read and skillful theologian, a good classical scholar, and not unfamiliar with modern languages. His degree of Doctor in Theology was given by the University of North Carolina. His duties as the rector of a parish, of course, occupied him chiefly; but as his tastes, developed in very early life, led him to give much of his leisure to the study of natural history. In all the departments that are included under this name, he was singularly well informed. Botany was, however, his favorite field, and in it he gained a very enviable reputation. He had thoroughly—none so much so—explored the plants of North Carolina from the sea to the mountains, and the monographs he published are very accurate and of great value. His correspondence on this subject, both at home and in Europe, was very extensive, and no man in the Southern States had a higher or wider reputation. For many years his investigations were mainly microscopic, and in cryptogamic botany he was in that region without a peer. The standard work of the Rev. Dr. Berkely on English mycology owed much to his minute and careful researches, and was at first published under their joined names. In the survey of the State, ordered by the Legislature, the department of natural history was entrusted to him, and his

report on the woody shrubs, etc., was of great and popular value. He had also ready for the press a treatise on edible mushrooms, which would be of much use to the people of this country, should it see the light.

These were his amusements, and such is an imperfect statement of the results. Yet they never diverted his thoughts or labors from the cure of souls, in which he delighted, or from his Master's cause, for which he lived. Besides the care of his own parish, he served for many years as a member of the Standing Committee of the Diocese of North Carolina. He was sent as a deputy to the General Convention and to the Southern Councils as often as he could be induced to accept the trust, and was the clerical trustee from North Carolina of the "University of the South," from its inception through his life, and rendered to its interests wise and faithful service.

To his family and parish, to which he was so dear, and to his diocese and brethren that so highly regarded his noble qualities and eminent usefulness, the departure of such a man is a most sad loss. One who had been in intimate relations with him for well nigh half a century may close this scanty sketch by saying that in all that time he has met no man to whom he gave a heartier esteem, or a more sincere affection; no man more true in word and deed, more steadfast in friendship, of a more beautiful simplicity, of a more sterling worth, of a more humble temper of devotion.

Science did not mislead him into the paths of skepticism; for him

"The earth was crammed with heaven,
And every common bush afire with God."

God's wondrous works were visible to him in every plant he saw, and all his converse with nature only drew him nearer to that divine life towards which it was his mission to lead his fellow men.

To our young men we point to his life as an example of the immense advantage of patient training, and of the renown it is possible to achieve by quiet, unobtrusive work, even in the stillness of the forest. Also to our young men, and to all men, we will say, his life was the proof that profound scientific study is not only not incompatible with profound faith in revealed religion, but is the safest path through which to attain it.

BIBLIOGRAPHY.

"Enumeration of Plants growing Spontaneously around Wilmington, North Carolina," with remarks on some new and obscure species, by Moses A. Curtis, A. M., vol. 1, No. 2, Boston Journal of Natural History, Communication Sept. 3d, 1834. *Reprint* with

many additions and emendations, the result of further research. *Reprint* with MS. additions and index, by Dr. James F. McRee.

"New and rare Plants of North Carolina," dated Hillsboro, N. C., Nov. 1, 1842. (Silliman's Journal, vol. 14, p. 80, Art. XI.)

"Contributions to Mycology of North America," by M. A. Curtis. (Sill. Jour., vol 6, 2d series, p. 349, Art. 33, 1848.)

"New and rare Plants, chiefly of the Carolinas." (Sill. Jour., vol. 7, p. 406, 1849.)

"Contributions to Mycology of North America," by Rev. M. J. Berkeley, of England, and Rev. M. A. Curtis, of South Carolina. (Sill. Jour., vol. 8, 2d series, p. 401, 1849.)

"New Fungi collected by the Wilkes Exploring Expedition," by M. A. Curtis. (Sill. Jour., vol. XI, p. 95, 1851.)

"Contributions to Mycology of North America," by Rev. M. J. Berkeley, of England, and Rev. M. A. Curtis, of South Carolina. (Sill. Jour., 2d series, vol. 9, p. 171, 1859, and vol. 10, p. 185.)

"Geological and Natural History Survey of North Carolina," part III, Botany. Containing a catalogue of the plants of the State, with description and history of the trees, shrubs and woody vines, by M. A. Curtis, Raleigh, 1860.

"A Commentary on the Natural History of Dr. Hawks' History of North Carolina," by Rev. Dr. Curtis, of Hillsboro, March, 1860.

"Esculent Fungi," by Rev. M. A. Curtis, in manuscript, with colored illustrations. (Sill. Jour., 3d series, vol. 42, p. 129, 1866.)

"Geological and Natural History of North Carolina, part III. Indig. and Naturalized Plants of North Carolina. Raleigh, 1867, pp. 155.

"Edible Fungi in North Carolina." Rev. Moses A. Curtis, D. D., Gardner's Chronicle, London, October 9th, 1869.

LATITUDE OF CHAPEL HILL.

J. W. GORE.

Prof. Julius E. Hilgard, chief of the United States Coast and Geodetic Survey, kindly loaned the University a portable Transit, Zenith Telescope and a Chronometer for the purpose of determining accurately the latitude of this place.

Not knowing sidereal time, the transit had to be placed approximately in position by observations on Polaris. After leveling the rotation axis and watching for *Alioth* or *Epsilon Ursae Majoris* and *Polaris* to come into the same vertical circle, then following Polaris for 17 minutes, fixing the instrument, which now is approximately in the meridian. By observing some well known star, such as *delta bootis*, which culminates near our zenith, we get a near approximation of sidereal time, and the chronometer was set.

Then followed a series of observations on time stars for the purpose of accurately adjusting the instrument in the meridian, and also for determining the error of the chronometer and its rate. The Zenith Telescope was easily set in the meridian by the aid of the Transit, when the preliminary work was done and we were ready to begin recording observations for latitude.

Talcott's method by circumzenith stars was followed. Several pairs of stars are selected, such that the two of each pair do not differ in zenith distance by more than about 20' of arc; one culminating north of the zenith and the other south. The difference in the time of crossing the meridian must be sufficient to read the instrument and turn it 180° in azimuth, though not too long for fear of changes in the state of the instrument.

The Telescope is set at a zenith distance, which is the mean of the zenith distances of the two stars, the star that culminates first is observed and its position in the field of view is determined by the micrometer, after noting the level the telescope is rotated 180°, about its vertical axis, and the second star will be in the field of view as it crosses the meridian, without altering the zenith distance of the instrument; its position is also determined by the micrometer. Thus the difference in the zenith distances of the two stars is determined, which is the only quantity to be measured.

Eight pairs of stars were observed, and twenty-five satisfactory observations of pairs taken between June 15th and July 3rd. The

value of one turn of the micrometer screw was determined by observations on *Polaris* when near its eastern elongation.

The method of the U. S. Coast Survey was employed in the reduction of the observations, and from the data the latitude was computed to be $35^{\circ} 54' 18''.57$ north.

The record of observations and the computations will be preserved by the Mitchell Society for future reference, should the determination of latitude ever be repeated.

The latitude of this place was determined several years ago by Dr. James Phillips to be $35^{\circ} 54' 22''$, though there is no record of the method employed or the position occupied by his instruments.

While the Transit was accurately adjusted in the meridian, two long stones were planted 175 feet apart, in the ends of which holes were drilled and filled with melted lead, and in the lead were driven small steel nails, marking the direction of geographic north and south. This fixed meridian direction will be used for determining the declination of the magnetic needle.

THE MANUFACTURE OF "ACID" PHOSPHATE.

W. B. PHILLIPS, PH. D.

It is always interesting to notice the play between theory and practice. The student among his books and the workman with his tools are one and the same person if the theory of the student is sustained by the results of practical work. And in no department of industry is the beautiful dove-tailing of what should be and what is more fully illustrated than in the manufacture of commercial manures. Not that this coincidence of calculation and actual result is even here perfect; quite the contrary, in fact. But the illustration loses nothing of its force by being along side of most things here, i. e., far from perfect. The manufacture of fertilizers, which has grown in 20 years from almost nothing to \$30,000,000, can hardly be said even now to be in a satisfactory condition.

It is true that with certain crude phosphates our pre-conceived notions of what they should yield on treatment with sulphuric acid are borne out by the analyses of superphosphates made from them. But I need hardly remind chemists and those acquainted with the trade that there still remain large quantities of rich phosphates beyond the reach of the manufacturer's skill. It is only very

recently that so good a material as the Mejillones guano has been successfully used. For Dr. Pieper (*Landw. Centralbl.* 1873, 1, 371) only a few years ago gave impetus to the use of this material. And there are other phosphates equally as good, which so far defy alike the chemist and the manufacturer. But with the ordinary grades of Charleston rock one can predict the actual result of treatment within very narrow limits. It is the purpose of this article to discuss briefly the action of sulphuric acid on some grades of Charleston rock.

The rock was ground so that the whole of it passed a 60° seive. It was then sampled and analysed.

The analysis was as follows :

	Per cent.
Moisture at 212°F.....	6.52
Loss at red heat (CO ₂ restored).....	3.83
Insoluble silica.....	17.84
Soluble silica.....	.10
Carbonic acid.....	2.80
Phosphoric acid.....	22.82
Lime.....	33.60
Ferric oxide, (Oxide of Iron).....	11.56
Aluminic oxide.....	.00
	99.07

The amount of oxide of iron is greater than is usually found.

The formula used was :

EXPERIMENT I.

Rock.....	1200 lbs.
Sulphuric acid, 47°B.....	1050 "

Temp. of acid 140°F. (60°C.)

" in pan 180°F. (82°C.)

Stirred 3 minutes and sampled direct from pan.

To show the difference between the "calculated" and "found" ingredients the subjoined comparison is given :

	Calculated. Per cent.	Found. Per cent.
Moisture at 212°F.....	24.51	27.75
Phos. acid sol. in water.....	9.30	8.53
" " insol. in water.....	2.88	2.92
" " total.....	12.18	11.45

Twenty-four hours after mixing, the temperature of the large pile of one hundred tons, of which this was a fair sample, was 180°F (82°C.), and the composition of it was as follows :

	Per cent.
Moisture at 212°F.....	16.50
Phosphoric acid Sol. in water.....	9.48
“ “ Insol. in water.....	3.67
“ “ Reverted.....	2.90
“ “ Insol. Am. Cit. 65°.....	.77
“ “ Total.....	13.15

The calculated analysis is based upon the following reaction :

$\text{Ca}_3\text{P}_2\text{O}_8 + 2\text{H}_2\text{SO}_4 = \text{CaH}_4\text{P}_2\text{O}_8 + 2\text{CaSO}_4$. That is to say : 200 pounds of 53°B acid are required to render soluble all the phosphoric acid in 100 pounds bone phosphate. As pure bone phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$) contains 45.81 percent. phosphoric acid, it follows that 4.36 pounds 53°B acid are required to render soluble 1 pound of phosphoric acid in bone phosphate, or 5.02 pounds 47°, (as 1 pound 53°B=1.15 pounds 47°). One pound (1 lb.) then of 47° acid renders soluble .20 lb. (two-tenths of a pound) of phosphoric acid in bone phosphate.

Let us assume for the moment that the above reaction is the *only* one that takes place. It is not really the *only* one, but for our present purpose we can take it so.

The 1200 pounds of rock used contained 273.84 pounds phosphoric acid ($12 \times 22.82 = 273.84$), therefore, to render the whole of it soluble we should have added 1374.67 pounds 47° acid. We actually used 1050 pounds 47°. The difference then between what we should have added and what we did add, multiplied by the co-efficient of solubility (in this case .20) represents the phosphoric acid we could have made soluble but did not. Thus $(1374.67 - 1050) \times .20 = 64.934$ pounds phosphoric acid insoluble in water, or 2.88 per cent, as $100 \div \frac{2250}{64.934} = 2.88$. Of course the difference between the total phosphoric acid and the insoluble in water gives the soluble phosphoric acid, but it can also be calculated, as $100 \div \frac{2250}{1050 \times .20} = 9.33$ per cent.

The presence of so much oxide of iron in the rock probably accounts for the discrepancy between the “calculated” and the “found” soluble phosphoric acid. The discrepancy between the two “moistures” arises from the fact that in the calculated moisture no allowance is made for carbonic and hydrofluoric acids. If these three

analyses of the acid phosphate be calculated on a *water-free basis*, so that they may be in the same condition, we can see at a glance how the matter stands.

TABLE I.

	Calculated.	Actual analysis at mixing.	Analysis of same article in bulk at end of 24 hours.
	per cent.	per cent.	per cent.
Phosphoric acid soluble in water....	12.29	11.81	11.34
“ “ insoluble in water..	3.71	4.04	4.41
“ “ reverted	-----	1.58	3.49
“ “ insol. am. cit. 65°	-----	2.45	.92
“ “ total	16.00	15.85	15.75

Shepard & Robertson have shown (in their very excellent pamphlet “on certain changes liable to occur in large heaps of acid phosphate,”) that if the mass maintains a high temperature (56°—61°C.) for several weeks, there may result a considerable loss of available phosphoric acid, (Available = Soluble + Reverted). But this change probably does not begin for several days after mixing, unless the crude phosphate used contained large quantities of iron and aluminum. If a sample is drawn from the pan just before discharging, put into a well closed bottle (corked), and cooled at once, and allowed to stand for several weeks at the ordinary temperature of the Laboratory, the reverse is the case. And the results obtained by Shepard and Robertson from stuff “which at no time after drawing the first sample exhibited a higher temperature than 50°C,” confirm this statement.

To test still farther the possibility of calculating out beforehand the probable composition of an acid phosphate, another experiment was conducted. The composition of the rock at this time was as follows:

	Per cent.
Moisture at 212°F.....	2.32
Loss at red heat (CO ₂ restored).....	3.03
Insoluble silica	11.56
Soluble silica.....	.14
Carbonic acid.....	3.33
Phosphoric acid.....	26.29
Lime	38.55
Oxide of iron (Fe ₂ O ₃)	3.35
Oxide of aluminum.....	3.07

EXPERIMENT II.

The formula used was :	Lbs.
Rock (60° seive)	1500
Sulphuric acid 46°B.....	1200
Temperature of acid 122°F. (50°C).	
Temperature in pan 160°F. (71°C).	
Sampled from pan, bottled, corked and cooled.	

	Calculated. per cent.	Found. per cent.
Phosphoric acid, soluble in water.....	8.73	8.81
Phosphoric acid insoluble in water.....	5.87	5.01
Phosphoric acid reverted		1.69
Phosphoric acid insol. am. cit. 65°		3.32
Phosphoric acid total	14.60	13.82
Moisture	21.73	22.45

From Experiments I and II it will thus be seen that it is possible to calculate within one per cent. of the actual analysis. If care be taken to use uniform qualities of rock and acid, and to mix thoroughly, *but not too much*, I believe that the difference can be brought within still narrower limits.

It may be of interest to some to have a compact working formula for calculating the probable yield of a given mixture, and I have prepared one. It is in fact the one I use constantly. With the higher grades of Charleston rock it may be relied upon to within 1 per cent.

Let a = amount of acid used.

m = " " " needed for complete decomposition.

c = coefficient of solubility.

w = total weight of mixture.

then

$$100 \times \frac{c(m-a)}{w} = \text{per cent. phosphoric acid insoluble in water.}$$

and

$$100 \times \frac{ca}{w} = \text{per cent. phosphoric acid soluble in water.}$$

To derive m , let x = per cent. H_2SO_4 in 53°B acid

y = " " " " strength of acid used.

z = No. of pounds 53°B acid needed for complete decomposition of 1 pound.

Phosphoric acid in bone phosphate = 4.36 (constant.)

p = pounds of phosphoric acid in mixture.

then

$\frac{zx}{y}$ = no of pounds acid used needed to render 1 pound phosphoric acid soluble.

and

$$p \frac{zx}{y} = m.$$

The coefficient of solubility is given by the formula $c = \frac{y}{zx}$

It is evident that some starting point is required, and for this it is most convenient to take 53°B., and to consider that the reaction given on p. 35 of this article is the true one, viz.: $\text{Ca}_3\text{P}_2\text{O}_8 + 2\text{H}_2\text{SO}_4 = \text{CaH}_4\text{P}_2\text{O}_8 + 2\text{CaSO}_4$. A stronger acid than 53°B is very seldom used in the manufacture of acid phosphates, and it is customary to say that two parts by weight of 53°B acid will completely decompose one part of bone phosphate. Of course c , will vary with the strength of acid used, for instance it will vary from .23 in 53°B acid to .19 in 46°B acid. It is perhaps needless for me to say there are many causes operating to prevent the universal application of these working formulæ. Foremost among these is the variation in the composition of the crude rock whereby compounds of phosphoric acid other than Tri-calcium Phosphate may exist. Then comes the variation in the fineness of the rock when the acid is added to it. This is a point of far greater importance than is generally supposed, and upon it depends in very large measure the quality of the resulting acid phosphate. It has been shown by a writer in Lippincott's Encyclopædia of Chemistry, vol. 2, p. 375, art. "manure," that in the case of Navassa Phosphate, there was obtained

from dust that passed a 38° seive	22.65	per	cent.	soluble	phosphate.
" " " " " 50 "	23.80	"	"	"	"
" " as fine as possible,	25.75	"	"	"	"

And he goes on to say, "No dust should be used which does not pass through a seive of 40 wires to the inch, and in the case of hard phosphates, still finer grinding is very desirable." If he had said that all the dust should pass a 60° seive, he would have been still nearer the truth.

Variation in the purity of the acid used is also a very important factor. It is well known that the strength of the acid, as given by Beaume's Hydrometer, is not always correct, when the chamber acid is employed, as the dissolved impurities cause a higher reading than the amount of acid justifies. The humidity of the atmosphere

has also a part in the quality of the acid phosphate. On a damp, muggy day, the mixer-man will say, "It works bad to-day," the rapidity with which the mass "dries out" being an element of manufacturing not to be despised.

Given a rock of good and uniform quality, acid of uniform and sufficient strength, and favorable weather, and the applicability of the formulæ here given is assured.

Laboratory Navassa Guano Co.

Wilmington, N. C.

ANALYSIS OF THE LEAVES OF ILEX CASSINE.

F. P. VENABLE.

The Yopon (*Ilex Cassine*, Linn), is described in Hale's "Woods and Timbers of North Carolina," as an elegant shrub 10 to 15 feet high, but sometimes rising into a small tree 20 to 25 feet. It has, according to the same authority, for its *habitat* the strip of country from Virginia southward along the coast, never extending, however, very far into the interior. The leaves are $\frac{1}{2}$ to 1 inch long, with a smooth surface, and fine serrated edge. The plant is an evergreen, and its dark green leaves and bright red berries make it attractive as an ornamental shrub. In the region of the Dismal Swamp, and in other sections the leaves are annually gathered, dried and used for tea. This decoction is, according to Hale, oppressively sudorific, at least to those unaccustomed to its use. The famous "Black Drink" of the southern Indians was made from the leaves of this shrub. "At a certain time of the year they come down in droves from a distance of some hundred miles, to the coast for the leaves of this tree. They make a fire on the ground and putting a great kettle of water on it, they throw in a large quantity of these leaves, and seating themselves around the fire, from a bowl that holds about a pint, they begin drinking large draughts, which in a short time occasions them to vomit freely and easily. Thus they continue for the space of two or three days, until they have sufficiently cleansed themselves, and then every one taking a bundle of the leaves, they all retire to their habitations." Having on hand a small sample of these leaves procured from New Berne during the

winter of 1883, it seemed desirable to make an examination of them to decide, if possible, the presence of any alkaloid or other principle which would make the decoction useful as a beverage. The usual treatment with magnesium oxide, exhaustion with water, separation by means of chloroform and subsequent purification, was adhered to, resulting in obtaining a small amount of a white substance slightly soluble in water, more so in alcohol, and easily soluble in chloroform, which gave distinctly the tests for caffeine, especially the murexide reaction, and very closely resembled a specimen of pure caffeine from Powers & Weightman.

This caffeine formed .32 per cent. of the dried leaves. Later on, in May, a much larger supply of the same leaves was gotten from the neighborhood of Wilmington. A more thorough examination of them was then made with the following results:

Water in air-dried sample.....	13.19
Extracted by water.....	26.55
Tannin	7.39
Caffeine .....	.27
Nitrogen (on combustion) .....	.73
Ash	5.75

The analysis of the ash is shown in column I.

	I.	II.
CaO	10.99.....	12.34
MgO	16.59.....	11.39
Na ₂ O .....	.47.....	7.28
K ₂ O	27.02.....	2.98
MnO ₂	1.73.....	2.50
Fe ₂ O ₃ .....	.26.....	3.41
SO ₃	2.50.....	.92
Cl .....	.66.....	.71
P ₂ O ₅	3.34.....	5.54
SiO ₂	1.32.....	44.75

The Maté or Brazilian Holly (*Ilex Paraguayensis*), belongs to the same genus. Its ash analysis, as made by Senor Arate, is given in column II. The plant grows wild in Brazil and is very largely used by the South Americans. It has, according to Peckolt (Pharm. J. Trans. [3] 14, 121—124. Abstract, Jour. Chem. Soc., 1884, 479), been planted, and seems to succeed well, in the Cape of Good Hope, Spain and Portugal. It is stated that six different species of *Ilex* are used in the preparation of this tea. Peckolt gives, in his analysis of the air-dried leaves, the per centage of caffeine as .639. The

average percentage of analyses, by different authors, is about 1.3. I can find mention of only one other Ilex used as a substitute for tea. The analysis of this by Ryland and Brown is quoted in Blythe's "Composition and Analysis of Foods," p. 343. It is called the Ilex Cassiva, is said to be used as a tea in Virginia, and the percentage of caffeine is given as .12. This is probably the same thing as the Yopon, the analysis of which is given above, and the "cassiva" may be a misprint for "cassine."

University of North Carolina.

ON THE DETERMINATION OF "TOTAL" PHOSPHORIC ACID IN FERTILIZERS.

F. B. DANCY.

The writer has been led to make a few comparative experiments on total phosphoric acid in fertilizers mainly by reason of the method adopted by the late convention of Agricultural Chemists in Philadelphia in September last. For a long time it has been my custom, as practiced in the Laboratory of the N. C. Experiment Station, to fuse the fertilizer with a mixture of one-half carbonate of soda and one-half nitrate of potash. I had always found the method most satisfactory and knew of no important objection to it. When, therefore, the Agricultural Chemists decided to use a very different one, I determined to try that method, find out the objections to it and then make as many comparative experiments of that and other methods, with our old "fusion" method, as my limited time would allow.

The lately adopted method referred to (which I shall call the "Philadelphia method") bears the impress of being a theoretical method, so many and so irksome are the practical difficulties to be met with in its pursuit.

The Philadelphia method is as follows :

Two grammes of fertilizer are intimately mixed in a capsule with 1-7 c. c. of a nearly saturated solution of magnesium nitrate; dry; ignite gently; if necessary, moisten the residue with nitric acid and ignite again to destroy organic matter; add to the residue 15-20 c. c. of fuming HCl; digest at a gentle heat until all phosphates are dissolved; dilute to 200 c. c.; mix; pass through a dry filter; take 50

c. c. of filtrate; neutralize with NH_4HO ; add about 15 grammes dry ammonium nitrate, and to the hot solution add molybdic solution sufficient to precipitate all the P_2O_5 present. Digest at about 65°C for one hour, filter and wash with ammonium nitrate solution.

Now in the first place the drying down with magnesium nitrate solution must of necessity be done over the water bath; it must, moreover, be transferred to the air bath and the drying finished at a higher temperature, else there will be loss from spitting when it comes to be ignited, however gently. It next requires a long ignition to destroy organic matter, and if, as the method suggests, moistening with HNO_3 becomes necessary the drying process must be repeated. It is quite difficult, also, to decide on a convenient form of capsule to be used. I tried two kinds in two different sets of experiments, one kind being simply an extra large best porcelain crucible, and the other being a capsule more on the order of a flat-bottomed evaporating dish. I made eight experiments with the crucibles and four with the "capsules." In *every single* instance in the case of both kinds they cracked at the "gentle ignition" stage. However carefully and slowly I applied the heat in each case, the ominous "crack" was heard, and this too some little while after they had attained their maximum temperature. Such wholesale breakage makes the method very expensive, and I cannot see how it can be avoided. In our fusions we always used platinum crucibles with economy. Now the ignited mass must be treated with fuming HCl . Whatever be the form of capsule used the violent chemical action caused by pouring HCl on this mass of MgO causes serious loss by spitting and it is not convenient to cover the capsule when the HCl is added. Afterwards, also, when digested at a heat however gentle, serious loss may again occur from spitting (to be avoided with much inconvenience) when the first bubbles of HCl gas are given off. And then in case one has a broken capsule, as I did in every instance, the capsule and contents must be enclosed in some other containing vessel (as a beaker) and there treated with HCl under cover of a watch glass. This necessitates the addition of a very large quantity of HCl in order to cover the crucible and contents, and the fumes from this HCl , in the case of a dozen or more analyses going on at once, render the atmosphere of the laboratory very disagreeable despite the use of a hood.

Such were the numerous practical difficulties I met with in the Philadelphia method.

For my experiments I selected four samples of commercial fertil-

izers with different kinds of organic matter in them. The samples were very carefully prepared and were made to pass a 20-mesh sieve.

1. Contained organic matter, fish-scrap and tobacco dust.
2. " " tankage," &c.
3. " cotton seed.
4. " dried blood, " ammonites," &c.

I determined total P_2O_5 in each of these by four methods. 1st, by the Philadelphia method ; 2nd, by dissolving directly in strong, boiling HNO_3 with the aid of lumps of $KClO_3$ thrown in from time to time,—long boiling ; 3rd, by fusion with $Na_2CO_3 + KNO_3$ and taking up with hot water and HNO_3 ; 4th, by burning off organic matter by fire and taking up in strong hot HCl .

Following are the results obtained :

TABLE I.

Sample.	Fusion with $Na_2CO_3 + KNO_3$	Dissolving in strong, boiling HNO_3 with $KClO_3$	Phila. Method.	Destroying organic matter by fire and taking up in strong, hot HCl .
	Percent. P_2O_5	Percent. P_2O_5	Percent. P_2O_5	Per cent. P_2O_5
1	10.25	9.26	8.93	8.88
2	12.02	11.92	11.67	11.93
3	10.66	9.54	9.91	10.00
4	10.29	9.21	9.12	9.29

The results from the fusion are seen in every case to be the highest. The HNO_3 and $KClO_3$ method cannot, I believe, be relied upon in any case, unless it be in case of sample 2. Three of the four cases where the organic matter was destroyed by fire gave higher results than the Philadelphia method. The lowness of the results by this latter method are due, I believe, to imperfect oxidation of the organic matter and to unavoidable loss from so much manipulation, despite the fact that the greatest care was taken.

Four more samples were taken and the fusion method compared with the Philadelphia method alone in these. The results obtained were much nearer together than in the case of the other samples, being larger again in case of the fusion method, but this time not materially so.

TABLE II.

	Fusion method.	Philadelphia method.
1.	11.70	11.67
2.	14.12	13.93
3.	13.52	13.50
4.	11.19	11.10

The painful precautions which Fresenius recommends to remove *chlorides* from a solution of phosphates before adding molybdic solution are, I believe, entirely necessary. But that the presence of free HCl is objectionable is shown by the following results, obtained from *identical* HCl solutions of phosphates, but in the one case precipitating in the HCl solution direct, and in the other neutralizing the HCl with NH_4HO and adding a little HNO_3 .

TABLE III.

	Precipitating in free HCl solution.	Neutralizing HCl and making HNO_3 solution.
1.	8.90	9.01
2.	11.59	11.72
3.	9.89	9.93
4.	9.17	9.24
5.	8.88	8.91
6.	11.93	11.88
7.	10.00	9.87
8.	9.29	9.27

It will be noticed that the difference is considerable in all cases except 5 and 8, and is on the other side in one case only (6), due, perhaps, to some error.

It seems to be a mooted question how far the presence of silica in solution effects the results in a determination of phosphoric acid. If it does form a precipitate and thereby makes the results too high, then it is the only objection I know of to the fusion method, for the Na_2CO_3 necessarily fuses some of the sand present in a fertilizer into soluble silicate. I resolved, therefore, to separate soluble silica from four solutions by fusion and compare per cents of P_2O_5 with per cents found before separation of silica. The silica was separated by careful evaporation over the water bath, transferring to hot air bath with higher temperature until all acid (HNO_3) was entirely removed, moistening with strong HCl, drying and heating thoroughly again, and finally taking up in hot H_2O with some HNO_3 .

and filtering from silica. The silica was also in each case determined. The amount precipitated was 50 c. c. of the solution, and the same four solutions were used that were compared with the Philadelphia method in the last eight comparative results cited, (Table II.)

	I.	2.	3.	4.
Four solutions with silica gave	11.70	14.12	13.52	11.19 (a.)
Four solutions with silica removed	11.52	13.61	11.55	10.30 (b.)
Difference .....	.18	.51	1.97	.89
SiO ₂ found	1.16	2.02	2.96	2.26

It is impossible to tell how far the differences between (a) and (b) are due to unavoidable loss incident upon two evaporations to dryness and extended manipulation, but the fact will be noticed at once that the differences in each case vary directly as the amount of silica found, but being in no case as much as the silica found. Strange to say also, if the presence of the silica tended to increase the per cent. of the P₂O₅ found, then there ought to be equally as much silica in the other four solutions from the Philadelphia method (Table II), because the per centages here of P₂O₅ are not materially greater than the per cents there, in fact, within the limits of error. I am inclined to the opinion that the presence of silica in large amounts is hurtful, but that if a fusion is carried only far enough to completely destroy all organic matter and reduce the fused mass to a homogeneous state and no farther, not enough silica is brought into the solution to do any harm—certainly very little more than is in an ordinary acid solution, such as is gotten by the Philadelphia method. For here are four fusion solutions showing practically the same per cents of P₂O₅ as four Philadelphia method solutions, and yet showing silica present in each case, and a diminution in per cent P₂O₅ when silica is removed. I therefore conclude that if proper precautions are taken not to fuse unnecessarily long, the fusion method is incomparably preferable to the Philadelphia method. Nor do I believe, from the results of the first set of experiments (Table I), that the Philadelphia method in many cases sufficiently oxidizes and destroys organic matter.

One more time-consuming objection to the Philadelphia method, inadvertently omitted above, I will mention here. Most copious and protracted washing of the yellow “phospho-molybdate of ammonia” with ammonium nitrate solution is necessary, in order to free it from the magnesium chloride which is formed when the MgO (after the ignition) is dissolved in HCl. Unless this is entirely

washed out, when the yellow precipitate is dissolved with ammonia, magnesium-ammonium phosphate may precipitate in the filter. I found that four washings by decantation and three subsequent washings on the filter failed to accomplish the entire removal of the magnesium chloride. Five washings by decantation and four washings on the filter failed to effect this entirely completely in every case. More washing than this, however, will remove the trouble, but at the expense of much time.

Raleigh, N. C., April 6th, 1885.

ANALYSIS OF SPIEGEL-EISEN.

MAX. JACKSON.

The specimen analyzed was one produced at the charcoal furnace of the American Iron and Steel Company at the Buckhorn Locks. The Buckhorn mining section lies in Chatham county, on the border of Harnett, and a full description of the economical geology of the district is given in Kerr's Geology, vol. I, 222. A very superior car wheel iron has been turned out by this company. The product is mainly spiegel-eisen. Partial analysis have been made by Mr. Lobdell.

In this analysis the directions in Cairns' Handbook were generally followed. The carbon was determined by Weyl's method, no attempt being made to distinguish between combined and uncombined carbon. The iron and manganese were separated according to the method described by Holthof (Zeit. f. Anal. Chem. 23.491). Sulphur, copper, nickel, cobalt, calcium and barium were tested for but none found. The figures in the analysis below are, in most cases, the means of two or more accordant determinations. For comparison, Lobdell's analysis are also tabulated under the II, III and IV.

	I.	II.	III.	IV.
Iron	95.03	----	----	----
Manganese	2.46	4.573	6.50	4.88
Silicon .....	.11	.233	.14	.38
Sulphur	----	.015	.009	----
Phosphorous .....	.10	.051	.12	.095
Carbon	2.35	----	----	----
Titanium,	trace.	----	----	----

The manganese in this specimen was in very small amount. The furnaces were probably "running on ordinary iron," and not attempting the production of spiegel-eisen, as was also the case in analyses II, III and IV. The phosphorus probably comes from the fluxes, as the Buckhorn ore contains only slight traces of this.

Chemical Laboratory, U. N. C.

OCCURRENCE OF CITRIC AND MALIC ACIDS IN PEANUTS, (*ARACHIS HYPOGÆA*.)

E. A. de SCHWEINITZ.

Citric, malic and oxalic acids have been shown by Ritthausen to exist in the seeds of the yellow lupine and other leguminous plants, *vicia sativa*, *vicia faba*, *phaseolus*. An examination of peanuts *arachie hypogæa* shows the presence of malic and citric acids. To detect them the seeds were extracted with water acidified with HCl, filtered, solution neutralized with NaHO, filtered and precipitated with basic lead acetate. This precipitate decomposed by H₂S and lime water added to the filtrate. This was again filtered and the filtrate boiled, Calcium malate, and citrate being precipitated. After boiling, the solution was allowed to cool and stand for twenty-four hours with frequent stirring and the Calcium malate then filtered off. The filtrate upon being again boiled, yielded a precipitate of Calcium citrate, which dried at 100° and weighed gave .055 per cent. citric acid.

As lime water when prepared with cold water does not precipitate malic acid until the solution is boiled, and as Calcium citrate is re-dissolved by cooling the solution after boiling, the two acids could be separated in this way.

Both precipitates, Calcium malate and Calcium citrate were dissolved and confirmatory tests for citric and malic acids made.

University of N. C.

METEOROLOGICAL RECORD AT CHAPEL HILL
FOR THE FIVE YEARS 1880-1884.

There is unfortunately quite a gap in the meteorological records kept at Chapel Hill. For sixteen years, 1844-'59, they were kept by Dr. Jas. Phillips, and his records were published in our last Journal (p. 35). There was then a period of twenty years, in which came the war and disorganization of the University, when no attention was paid to such matters. In 1880, fresh instruments were procured and Dr. Wm. B. Phillips, grandson of the former observer, recorded his observations. Since September, 1881, the records have been kept by Dr. F. P. Venable, with the kind assistance of Dr. Charles Phillips, and since January, 1883, these records have been each month transmitted to Washington, thus placing Chapel Hill in the list of voluntary Signal Service Stations. The five years of observations reported in this paper make a total of twenty-one years, with the sixteen years already published, and give a fair idea of the climatology of this locality. Still the gap of twenty years is much to be regretted. The books of Dr. Jas. Phillips were destroyed, and only his published monthly averages and sums are extant. The observations for the past five years are complete, and hence admit of more detailed discussion.

TEMPERATURE.

The mean annual temperature for the five years is 59.77° , for sixteen years 59.32° , for twenty-one years 59.42° . The lowest annual mean is in 1882 (58.69°). The highest is 1880 (60.90°), which is the highest annual mean for the twenty-one years.

The average temperature for the seasons is, Spring 58.35 , Summer 77.25 , Autumn 61.08 , Winter 42.39 . The warmest month of the year is July, with a mean of 78.69° . For August, 1881, the mean was 81.60 . The maximum daily mean was, June 12, 1880, 90.7° , and the maximum observations July 22d, 1883, 102° . On July 30th, 1856, the thermometer registered 105° . The coldest month is January, with a mean of 39.02 . The lowest monthly mean is 35.20° for January, 1881. The minimum daily mean was 10.50° for January 6th, 1884, and the minimum temperature observed was -2° at 7 A. M. December 30th, 1880. This is the lowest temperature observed in the twenty-one years. This gives a range of 104° for the five years, with a mean annual range of 92.4° .

HUMIDITY.

The average annual mean humidity is 71.18. January has the highest average 77.24, and February the lowest 68.88. The six months from August through January have means above the average; the remaining six are all below. The month with the most saturated atmosphere was January, 1883, the mean being 83.67. The least saturated atmosphere was during April, 1880, with a mean of 57.60. The mean saturation for spring is 69.77, for summer 71.54, for autumn 72.41, for winter 73.21. The lowest observations were 17 on April 5th, 1881, and March 31st, 1884, at 2 p. m.

RAIN-FALL.

The mean annual rain-fall was 41.64 inches. The largest monthly sum was 9.34 inches for August, 1880. One month, January, 1881, is recorded as being entirely without rain. The heaviest single rain-fall was 4.19 inches on April 22d, 1883, (see this Journal for 1883-'84, p. 83). March, with an average of 4.74, is the month of largest rain-fall, December (4.30 inches), August (4.25 inches), and April (3.97 inches), coming next. There is no apparent division into wet and dry seasons, the six months mentioned under humidity as being most saturated have about the same average rain-fall as the other six. Spring has an average of 11.25 inches, summer 11.58 inches, autumn 8.08 inches, winter 10.76 inches. The monthly average is 3.47 inches. The range is from 34.50 inches in 1881, to 49.82 inches in 1883, or 15.32 inches.

PRESSURE.

No comparisons can well be made between the barometric observations for the five years, as the first three were corrected for temperature only, and the last two for temperature and an elevation of 500 feet. The true elevation is 514.47 feet. (This Journal for 1883-'84, p. 82). So far as the range is concerned, the mean annual is 1.240 inches. The greatest annual range was 1.348 inches in 1881, and 0.969 inches in 1880 was the lowest. January (1.095 inches) and February (1.078 inches) are the months of greatest range. July, August and September present the least range. January, February and November are the months of highest barometer, and April and June are the months of lowest barometer. As the mere statement of the monthly range can give no idea of the number of changes or barometric waves, these waves have been added up for the various

months, taking a rise and fall of 2 inches as a wave or total wave, length 4 inches. March is seen to be the month of greatest change, and the six months, November—April show a much more variable barometer than the remaining six.

WINDS AND SKY.

Our winds are mainly from the west. Out of 5,192 observations, 1088 were west. Of south winds there are only 320 observations, the least frequent of all the winds. In January and August easterly or northerly winds prevail, in February southwesterly. The remaining months are variable. Our storms usually come from the northwest, summer and spring rains from southwest, and winter rains from northeast, westerly winds bringing clear weather. Set rules, however, cannot be laid down from this short series of observations.

Observations of the cloudiness give an average per year of 67 clear days, 78 cloudy, and 220 fair. The term fair is used for partial cloudiness. The average of clear and cloudy days during autumn months is very low (about 3 of each). In winter the number of clear and cloudy days rises to over half the total number in the month. In the table the term rainy days is used for days on which .01 inches or more of rain-fell.

GENERAL REMARKS.

The year 1881 was noted as a most disastrous one to farmers in this section. An unusually cold and dry winter was followed by a very hot summer, with a rain-fall 4.83 inches under the average. The total rain-fall was 7.14 inches below the average. In 1882, the crops, especially those of small grain, were remarkably fine, no one recalling such yield per acre of wheat and oats. A warm and wet spring was followed by a temperate summer, with plenty of rain. The maximum temperature was 94°. The average of atmospheric saturation was high.

The drought in the fall of 1884 was the most noteworthy meteorological fact of that year. It was the longest on record, lasting from September 17th, when .02 inches rain fell, to October 22d, when .80 inches fell, or 35 days without a drop of rain. So far as the effects of the drought were concerned, the preceding 18 days might also be counted in, as only one rain of .50 inches came in that time. The ground became excessively dry during this time, and the dust will be long remembered by all in attendance upon the State Exposition at Raleigh. The days from September 29th to October 7th

were the warmest consecutive eight days on record, the thermometer rising to 98 and 100 degrees, except on two days, when it registered 95 and 93. The mean temperature for September, October, November and December was about two degrees above the average. The rain-fall for September, October and November was 2.96 inches, or 5.12 inches below the average. In December good rains fell. The fall planting was greatly delayed by this drought, many farmers being forced to plant in the dust. It came too late, however, to greatly injure the grain crops.

The following three tables will need no further explanation. Table I gives the monthly means for temperature, humidity and state of the sky. Table II contains the monthly ranges of barometer, barometric waves and rain-fall. Table III gives the annual means and ranges.

TABLE I.

MONTHS.	TEMPERATURE.						HUMIDITY.						SKY.																			
	1880.		1881.		1882.		1883.		1884.		mean		1880.		1881.		1882.		1883.		1884.		mean		Clear Days. mean.		Cloudy Days. mean.		Fair Days. mean.		Rainy Days. mean.	
	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	Clear Days. mean.	Cloudy Days. mean.	Fair Days. mean.	Rainy Days. mean.				
January	49.00	35.20	39.75	35.89	35.27	39.02	75.80	73.90	82.89	83.67	69.92	77.24	6.6	10.2	14.2	9.6																
February	48.03	42.50	47.55	47.09	49.56	46.95	61.70	63.40	70.28	75.39	73.66	68.88	7.6	5.8	14.6	7.0																
March	50.20	45.80	50.93	43.84	51.45	48.44	67.57	60.40	71.44	67.12	70.15	69.34	6.8	8.8	15.4	10.8																
April	62.42	54.90	58.55	56.28	56.48	57.73	57.60	61.90	74.32	76.01	62.48	70.46	6.5	6.0	17.5	8.2																
May	75.11	68.80	64.13	67.20	69.09	68.87	61.45	68.60	74.42	77.87	67.27	69.52	4.2	5.8	20.9	7.0																
June	79.36	75.20	78.00	75.07	72.48	76.02	64.60	68.50	70.72	74.55	76.10	70.89	2.5	3.6	23.0	8.8																
July	80.94	80.47	76.06	79.20	76.67	78.67	70.70	64.10	75.22	69.31	74.85	70.84	2.8	3.6	24.6	8.6																
August	77.20	81.60	74.70	76.43	75.35	77.06	73.80	67.20	81.78	67.10	74.57	72.89	2.6	5.4	23.0	6.8																
September	69.70	77.80	70.19	68.58	73.21	71.89	68.80	71.40	80.45	77.71	67.89	73.25	4.8	4.8	20.4	5.4																
October	58.90	66.40	62.89	60.77	65.17	62.63	67.60	66.10	79.87	79.67	65.12	71.67	7.6	5.6	17.8	5.6																
November	44.30	50.90	45.72	51.82	50.93	48.73	73.60	75.50	74.20	65.24	73.02	72.31	7.8	11.0	11.2	5.8																
December	35.90	45.84	35.86	44.82	43.19	41.12	74.60	69.93	77.07	70.31	75.70	73.52	7.2	7.2	16.6	7.2																

TABLE II.

MONTHS.	BAROMETRIC RANGE.						BAROMETRIC WAVES.						RAIN-FALL.																				
	1881.			1882.			1883.			1884.			1880.			1881.			1882.			1883.			1884.			mean					
	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean	1880.	1881.	1882.	1883.	1884.	mean			
January	---	1.154	1.103	.936	1.187	1.095	---	6	7.5	6.5	7	6.7	---	.31	.00	7.18	5.02	4.33	3.37	---	1.79	3.20	4.05	3.84	2.58	3.09	---	4.74	3.80	1.95	6.91	6.20	4.74
February	---	1.207	1.219	.730	1.155	1.078	---	8	7	7.5	6	7.1	---	4.74	3.80	4.05	3.84	2.58	3.09	---	1.91	4.70	3.19	7.35	2.68	3.97	---	1.91	4.70	3.19	7.35	2.68	3.97
March	---	1.015	.829	.884	.928	.914	---	8	7.5	8	9	8.1	---	1.91	4.70	3.19	7.35	2.68	3.97	---	1.91	4.70	3.19	7.35	2.68	3.97	---	1.91	4.70	3.19	7.35	2.68	3.97
April	.493	.663	1.012	.740	.536	.685	---	5.5	6	6.5	6.5	6.1	---	1.91	4.70	3.19	7.35	2.68	3.97	---	1.91	4.70	3.19	7.35	2.68	3.97	---	1.91	4.70	3.19	7.35	2.68	3.97
May	.434	.641	.704	.929	.810	.704	4	3	5.5	3.5	4.5	4.1	---	.24	2.45	3.45	1.60	4.97	2.54	---	.24	2.45	3.45	1.60	4.97	2.54	---	.24	2.45	3.45	1.60	4.97	2.54
June	.593	.549	.518	.711	.654	.605	4	5	3	3	4	3.8	---	2.52	3.15	3.02	5.67	3.89	3.05	---	2.52	3.15	3.02	5.67	3.89	3.05	---	2.52	3.15	3.02	5.67	3.89	3.05
July	.422	.596	.610	.570	.303	.500	2	3.5	2.5	3	2	2.6	---	3.40	1.80	3.33	3.25	6.63	3.68	---	3.40	1.80	3.33	3.25	6.63	3.68	---	3.40	1.80	3.33	3.25	6.63	3.68
August	.543	.484	.519	.354	.406	.461	5	4	4	2.5	2.5	3.6	---	9.34	1.80	2.78	2.67	4.64	4.25	---	9.34	1.80	2.78	2.67	4.64	4.25	---	9.34	1.80	2.78	2.67	4.64	4.25
September	.546	.443	.718	.698	.570	.595	3	3	2.5	4	3	3.1	---	1.11	3.40	2.25	6.65	.52	2.79	---	1.11	3.40	2.25	6.65	.52	2.79	---	1.11	3.40	2.25	6.65	.52	2.79
October	.732	.775	.476	.860	.612	.691	6	5	3	3	5	4.5	---	2.05	2.85	3.43	3.25	.83	2.48	---	2.05	2.85	3.43	3.25	.83	2.48	---	2.05	2.85	3.43	3.25	.83	2.48
November	.934	.943	.584	.733	.978	.834	8	6	6.5	4	5.5	6.0	---	6.85	3.13	.67	1.77	1.61	2.81	---	6.85	3.13	.67	1.77	1.61	2.81	---	6.85	3.13	.67	1.77	1.61	2.81
December	.768	.946	.730	.768	.967	.836	7	5.5	8	6	7	6.7	---	5.50	4.20	2.97	1.84	6.98	4.30	---	5.50	4.20	2.97	1.84	6.98	4.30	---	5.50	4.20	2.97	1.84	6.98	4.30

TABLE III.

YEARS.	1880.	1881.	1882.	1883.	1884.	Sums.	Means.
TEMPERATURE.							
Annual Mean	60.90	60.45	58.69	58.92	59.90	298.86	59.77
July	July	Aug.	June.	July	July		
Monthly Maxima	80.94	81.60	78.00	79.20	76.67	396.41	79.28
Dec.	Dec.	Jan.	Dec.	Jan.	Jan.		
Monthly Minima	35.90	35.20	35.86	35.89	35.27	178.12	35.62
Mean 7 A. M.	55.57	54.30	54.79	53.36	53.60	271.62	54.32
" 2 P. M.	67.24	67.69	65.07	68.40	71.73	340.13	68.02
" 9 P. M.	56.60	58.69	56.86	57.45	57.61	287.21	57.44
Daily mean Max.	90.70	89.30	85.70	72.52	87.00	425.22	85.04
Daily mean Min.	9.00	19.30	18.25	44.70	10.50	101.75	20.35
J'ne, J'y	J'ne, J'y	J'y, A'g	June.	J'y	J'y, Oct		
Max. Observation	99	98	94	102.	100.	493.	98.60
Dec.	Dec.	Jan.	Dec.	Jan.	Jan.		
Minim. Observation ..	-2	16	8	9	0	31.	6.20
HUMIDITY.							
Annual Mean	68.16	67.40	75.80	73.66	70.89	355.91	71.18
Monthly Maxima	75.80	75.50	82.89	83.67	76.10	393.96	78.79
Monthly Minima	57.60	60.40	70.28	65.24	62.48	316.	63.20
Mean 7 A. M.	76.78	76.80	83.52	81.83	81.84	400.77	80.15
" 2 P. M.	54.68	54.77	64.55	59.45	54.50	287.95	57.59
" 9 P. M.	72.90	71.48	78.87	79.68	77.39	380.32	76.06
Minim. Observation ..	20	17	23	20	17	97.	19.40
Total Rain-fall	39.76	34.50	38.27	49.82	45.86	208.21	41.64
Total clear days	54	50	71	86	71	332.	66.40
Total cloudy days	78	53	101	97	62	391.	78.20
WINDS.							
North	62	64	101	53	62	342.	68.40
Northeast	70	51	152	237	160	670.	134.
East	221	192	79	76	125	693.	138.60
Southeast	81	83	128	82	63	437.	87.40
South	63	56	141	37	23	320.	64.
Southwest	130	136	118	250	173	807.	161.40
West	205	261	144	171	307	1088.	217.60
Northwest	165	200	177	160	133	835.	167.
BAROMETER.							
Annual Mean	29.695	29.525	29.558	30.170	30.086	149.014	29.803
Maxim. Observation ..	30.098	30.148	30.101	30.720	30.759	151.826	30.365
Minim. Observation ..	29.129	28.800	28.837	29.436	29.424	145.626	29.125
Range	0.969	1.348	1.264	1.284	1.335	-----	1.240

CERTAIN REACTIONS OF PHOSPHORUS.

F. P. VENABLE.

I wish to gather, under this heading, some scattered observations which I have made in working with phosphorus during the past year. No great claims to originality are made. Some are but new applications of old principles.

Sidot (*Compt. Rend.*, 84, 1454) has described the action of phosphorus upon a solution of copper sulphate. My own observations agreeing with his, show that the solution is decomposed with the formation of copper phosphide, metallic copper, sulphuric acid and phosphoric acid. The stick of phosphorus first becomes black and then speedily coats itself with metallic copper (often crystalline). This crust is easily removed with a sharp wire or knife, the phosphorus may be dissolved away with carbon disulphide, leaving the black phosphide. Traces of copper sulphate are capable of thus blackening the phosphorus, affording a delicate test for copper. The oxidation of the phosphorus thus coated with copper is very slow. It can be left exposed to the air for months without danger. The rapidity with which the coating takes place, and the phosphorus is rendered harmless, suggests the use of a copper sulphate solution where small pieces of phosphorus escape into cracks of a table or floor, or get beneath the finger-nail. A little of the comparatively dilute solution removes the danger of fire and prevents the serious injury which comes from a phosphorus burn.

Blyth (*Poisons; Effects and Detection*, p. 667) recommends copper sulphate as an antidote for phosphorus poisoning, giving it as an emetic. Very probably its beneficial action is also due to the insoluble copper phosphide which immediately covers the phosphorus. Else why not use some safer emetic? Why is copper sulphate the best, as stated by Blyth.

W. Schneid (*Zeit. Chem.* IV, 161, quoted by Watts) mentions the precipitates given with certain metallic solutions by phosphorus dissolved in carbon disulphide. Only a few metallic solutions can be decomposed in this way. The best precipitates are gotten with copper, silver and mercury. An examination of these precipitates showed that they were not the phosphides alone. The precipitate gotten by shaking the solution of phosphorus with a solution of copper sulphate is made up of small brownish black grains which,

after washing with water, alcohol and ether, take fire spontaneously on drying. This shows that much phosphorus is precipitated also, enclosed in and carried down by the metallic phosphide. Washing with carbon disulphide did not remove this. Careful drying, with exclusion of air, weighing, oxidizing and dissolving in nitric acid and determining the copper, gave in three experiments as the percentage of copper 10.44, 6.95 and 6.77. If this precipitate be left some days in contact with an excess of the copper solution, or covered over with alcohol, (water might have answered the purpose, but was not used), it becomes non-inflammable, and is copper phosphide. The silver precipitate acts in the same way, at first inflammable, after long standing non-inflammable. It is black in color, but usually not so homogeneous in appearance as the copper precipitate, having white grains in it lighter than the rest, and tending to rise to the surface of the washing liquid.

Agitation with water alone does not precipitate the phosphorus from its solution in carbon disulphide, nor does water with other metallic salts than those mentioned, dissolved in it. Lead salts, for instance, give only a dingy scum. Agitation with alcohol will cause a precipitation of the phosphorus, and so also with ether.

If the precipitate is covered with alcohol and left a month or so at ordinary temperatures, the alcohol becomes denser and strongly acid, and the phosphorus disappears from the precipitate. On attempting a distillation, the alcohol first comes over. This alcohol is still slightly acid and becomes milky on adding water. The fine milky white precipitate cannot be caught on a filter. It smokes on exposure to air as phosphorus does. For the remaining liquid the thermometer rises a few degrees above 100° , then falls with rapid evolution of gas. If distillation is persisted in, a few c. c. of a dense syrupy liquid with a strongly acid reaction are left. There is probably a formation of ethyl phosphoric acid then, and this is decomposed by the distillation. Alcohol poured over any finely divided phosphorus acts very similarly.

Chemical Laboratory, U. N. C.

NOTES ON A "PETRIFIED HUMAN BODY."

T. W. HARRIS AND J. A. HOLMES.

During the past autumn several papers published accounts of a "petrified" human body, discovered at Bell's Cross Roads, Chatham county, N. C. Through the kindness of the friends of the body, permission was granted the writers to make an examination of the case, with the following results:

The body was that of a white woman, past middle age, who died in March, 1879, and was buried a short distance from the cemetery at Bell's Cross Roads. After remaining in this place for six years, it was taken up and removed to the cemetery. During this removal it was observed that the form of the body was well preserved, and the surface comparatively hard, and hence the report as to petrification.

At the time of our examination (April last), upon re-excavation, the body exhibited the same characteristics. The features of the face, the ears and nose were gone, but the general form of the limbs and other external parts of the body were well preserved. The outer surface was rather dark in color. The clothing was still in place but pretty well decomposed. The body was light in weight, and showed no tendency toward falling to pieces on exposure to the air. On examination we found, as we had anticipated, and what is probably true of all the reported cases of so-called petrified human bodies, that there was no petrification at all, but the formation of adipocere. That is, all over the body the adipose tissue just under the skin, instead of decomposing, as it does ordinarily, had changed into a light colored granular substance, soapy to the feel, and otherwise possessing the characteristics of adipocere. This layer of adipocere was firm but easily cut with a knife. It varied in thickness from $\frac{1}{10}$ of an inch over the arms, to $\frac{1}{2}$ inch through the mammary glands.

The muscular tissues of the body had not generally undergone a similar transformation, but had disappeared, so that cutting through this outer layer of adipocere on the limbs, the space between it and the bones was hollow, except that here the muscle sheaths of connective tissue were in many cases in place, and sufficiently well preserved to be readily distinguished. On examination of the heart, however, here the thick muscular walls appeared to have changed in part to adipocere. The connective tissue of the heart was soft

and easily torn, but in part fairly well preserved. The valves between the auricles and ventricles were preserved in place and shape. The arteries and veins were hardly to be distinguished at any point. Other thoracic and abdominal organs had disappeared, excepting partly decomposed connective tissue which they contained. The bones of the body were considerably altered. The outer compact layer was neither so thick nor so hard as normally. Thin bones, as ribs, were easily cut with a knife. The inner portion of the ribs, radius and ulna (including the marrow) was also changed to adipocere.

The body had been originally buried in moist earth, and at the time of removal (six years later) water was found standing in the bottom of the coffin. There was nothing to indicate whether or not the body had been for any length of time covered with water. But having been buried during early spring, the rainy season of that section, it is probable that not long after burial the water passed from the surrounding soil into the case in sufficient quantity to keep the body thoroughly moist, if not wet. It is believed that animal bodies do not undergo such a change, except when submerged beneath water, or buried in places where there is an excess of moisture, and a scarcity of oxygen.

ANALYSIS OF A DEPOSIT FROM SALT-MAKING.

W. B. PHILLIPS, PH. D.

During the late war between the States the difficulty of procuring salt for domestic and government consumption induced its manufacture in some of the south-eastern counties of the State. These establishments were located along the coasts of Brunswick and New Hanover counties, among others, and the method employed was a simple concentration of sea water in shallow iron pans to the crystallization point of the sodium chloride. A series of pans enabled the operator to work cheaply and expeditiously. There would thus be left in the pans begining with No. 1, deposits forming an ascending scale of solubilities, the least soluble salts in pan No. 1, and so on. We would of course naturally expect this to be the case, and an opportunity has been presented to me for verification of what we might expect from pan No. 1. The most insoluble substance in sea water

is calcium sulphate, and we might expect to find it composing the No. 1 deposit. Through the kindness of Mr. Donald McRae, of Wilmington, N. C., I have secured a piece of this No. 1 deposit. It is very hard and tough, of a light greyish color, and dense structure. The analysis shows :

	Per cent.
Loss at 100°C.	9.74
Loss at 115°C.	1.96
Insoluble in HCl (after fusion)	1.00
Ferric oxide .....	.32
Magnesium oxide .....	.89
Calcium oxide	34.79
Sulphuric anhydride	49.19
Undetermined.	2.11
	<hr/>
	100.00

The SO_3 calculated to $\text{CaO} \cdot \text{SO}_3$ gives 83.62 per cent., containing CaO 34.43 per cent., which leaves .36 per cent. CaO , in some other combination. It is not likely that any of the SO_3 is combined with the magnesium, as none was yielded to boiling water. It may be that the excess of CaO , and the MgO exist in some form not determined. But that the deposit is calcium sulphate we cannot doubt, nor that it was formed as we would expect it to be, viz: in the first evaporating pan.

This specimen was from the old salt works at Masonboro Sound, New Hanover county.

ANALYSIS OF CRYSTALS OF DOG-TOOTH SPAR,
FROM GANDER HALL, NEW HANOVER
COUNTY, N. C., E. SIDE CAPE FEAR RIV-
ER, 15 MILES BELOW WILMINGTON.

W. B. PHILLIPS, PH. D.

These crystals were found lining the interior of shells, and were first brought to my attention by Mr. Donald McRae, of Wilmington. They presented the usual characteristics of the Dog-tooth Spar, and mention is here made of them on account of their almost perfect purity. Thus for instance,

weight of crystals taken.....	= .2224	gm's.
CaCO ₃ found.....	=.22230	"
CaO ".....	=.12448	"
CO ₂ ".....	=.09782	"
yielding CaCO ₃ 99.95 per cent.		

The locality is an interesting one. It is about 1200 metres back from the river, where there occurs a notable deposit of a very coarse-grained coquina, much used by the U. S. government for the break-waters at the mouth of the river. This coquina is obtained from openings in the face of a bluff some four or five metres in height, and the general course of it is parallel with the river. It is of two kinds, fine and coarse, with much intermixed quartz sand, and contains many complete shells of various sizes, besides of course innumerable small fragments of shells, which constitute the main portion of it. The rock is of various degrees of hardness, some of it crumbling under pressure of the hand, and then again requiring a smart blow of a hammer. Exposed to the action of sea water it hardens, and resists the beating of the waves as well or even better than many denser rocks.

The crystals are found within the larger shells, some of which are 7 decimetres long by 4 decimetres wide. Occasionally the coquina completely covers these shells, and on breaking it off the interior of the shell is most beautifully lined with the carbonate, presenting an exquisite appearance, as the pellucid crystals are suddenly uncovered. A most remarkable geological phenomenon is to be seen at this locality, viz : the existence of large pot-holes in the

coquina, showing that after it had been laid down it was subjected to the action of powerful currents rolling stones along. Some months ago when I visited the place, in company with Dr. W. C. Kerr and Mr. Bacon, U. S. Engineer, we found several of these holes 1 and 2 metres in depth, and from .50 to 2 metres in breadth. One of them especially interested us. It was 2 metres in depth and 2 metres in breadth, and had scalloped sides, with the convexity turned inward, as if several small holes had combined to make this large hole. Considering the age of this deposit, the general flatness of the surrounding country, and the remoteness of stones that could be used as drills, we have here a most enticing subject for investigation. And it is to be hoped that some enthusiastic young geologist of our society will win his spurs by an elaborate paper on this coquina. This scalloped hole has been drilled into the hardest rock, and must have been some time in the cutting. Whence came that couple-forming current and the stones? The deposit is nearly a mile from the river, with considerable bluffs between, and the river itself has here cut its way down twenty feet into the sand and clays. But then perhaps the river did not drill those holes. Well, the holes are there and must be accounted for, and any one who likes can undertake the work.

SOME NOTES ON PLANT TRANSPIRATION.

F. P. VENABLE.

The announcements of results differing from those commonly accepted, made by certain recent experimenters in this line, led to a collection of all within my reach relating to the subject and a repetition of some of the experiments. Unfortunately I could only refer to abstracts of the original articles. The author's methods of experimenting were consequently unknown to me. I present the results of my own investigation, with the hope that some members of the society may be tempted to confirm them by their own experiments.

Wiessner in Biedermann's Centralblatt for 1883, p. 471, has noticed that moistened leaves of plants transpire more freely than dry, consequently a larger quantity of water is withdrawn from the soil by the roots. He adds: "If there is plenty of moisture in the ground the plant flourishes, but if otherwise, it droops and languishes.

Plants should not be watered on the leaf unless the soil is likewise moist. The small amount of extra transpiration caused by dew can do no harm, as it is almost certain that the ground will be sufficiently moist to supply the requisite amount of water. The action of rain is more beneficial still, for then the supply of plant food is most rapid."

The same author notes (Bied. Centr. 1884, 43,) that in most plants the leaves transpire moisture in larger quantities than the flowers, and as a rule cut flowers wither more slowly than leaf twigs. If the transpiration of the leaves is arrested the cut flowers will remain a long time fresh as when severed, so that it would seem the flowers are deprived of moisture by the leaves.

Johnson says that the wilting of a plant results from the fact that the leaves suffer water to evaporate from them more rapidly than the roots can take it up. The speedy revival of a wilted plant on the falling of sudden rain or on the deposition of dew depends not so much on the absorption by the foliage of the water that gathers on it as it does on the suppression of evaporation, which is a consequence of the saturation of the surrounding air with moisture.

Bochen, as quoted by Johnson, (How Crops Feed, p. 204,) has arrived at the conclusion that transpiration absolutely ceases in air saturated with aqueous vapor. Yet Unger has shown that plants lose weight in air saturated as nearly as possible with vapor when their roots are not in contact with soil or liquid water, and Duchartre has shown that plants do not gain, but sometimes lose, weight when their foliage only is exposed to dew or even to rain, although they increase in weight when rain is allowed to fall upon the soil in which they are planted.

Hoffman says that dew entirely prevents transpiration. No criticism of these is possible without reference to the originals. I will merely recount some of my own experiments.

To see if transpiration ceased in a saturated atmosphere, weighed leaves of Morning Glory (*Convolvulus Major*) were suspended in a bell-jar over a saucer of water. The ground edge of the jar fitted closely to a ground glass plate. The jar was fitted with glass tubes so that air could be sucked in. This air first passed through .3—.4 metre of water and was used to fill the jar with saturated air immediately after putting in the leaf. Two experiments were made, the leaves remaining 8 and 9 hours at a temperature of about 25°C.

I. Weight of leaf 2.8490; loss .0870, or 3.02 per cent.

II. Weight of leaf 1.1820; loss .0090, or .76 per cent.

The loss is, then, a decided one. The leaves of the *convolvulus*

major were chosen because they transpire water rapidly and in large amounts, and hence any change would be more apparent.

The relative transpiration of moistened and dry leaves was tested by fastening leaves with wax in test-tubes filled with water, and allowing the evaporation to go on during several days. The stems dipped equal distances beneath the surface of the water and the leaves to be kept moist, were in some cases wetted with a sponge, in others by the spray from a wash bottle. The leaves were placed in the diffuse light of the laboratory and inequalities in the exposure to the light neutralized by interchanging the position of the tubes. Various leaves were experimented upon—maple, grape, geranium, convolvulus major, and in all cases, at the end of three or four days, the transpiration and consequent loss of water in the tubes had gone nearly twice as far where the leaves were dry as where they were wet. Of course these leaves were not wet all the time. They were kept continuously wet during a greater portion of the day, but dried off at night. Yet even this greatly retarded the evaporation, a result directly contrary to Wiessner. Again, to test this transpiration, leaves of the geranium and of the zinnia were weighed and then allowed to lie, the one on paper and the other on glass with occasional wettings. These last were dried between filter paper before reweighing. This would show the difference of transpiration by the loss of the original water of the leaf. The results were as follows:

Loss.	Wet Leaves.	Dry Leaves.
I. After 6 hours.....	6.6 per cent.	9.0 per cent.
“ 24 “	13.7 “	14.5 “
“ 30 “	15.5	16.0
II. “ 24 “	36.6	39.8

As to flowers transpiring more slowly than leaves, and hence cut flowers with leaves wilting more rapidly than those without, Wiessner's term, “most flowers,” is indefinite. I have tried geraniums, zinnias and convolvulus.

The weights in the other cases show the relative loss of water:

Loss.	Flowers.	Leaves.
I. After 6 hours.....	10.6 per cent.	9.0 per cent.
“ 24 “	24.8 “	14.5 “
“ 30 “	28.4 “	16.0 “
II.	Flowers and leaves.	Leaves.
“ 24 “	29.3 per cent.	28.9 per cent.
“ 26 “	30.8 “	30.5 “
“ 30 “	33.9 “	33.8 “
“ 48 “	50.3 “	49.8 “

In experiment I the loss of the flower alone (geranium) is shown to be much more rapid than that of the leaf. In experiment II the flower and leaf (zinnia) loses a larger per centage in the same time than the leaf, but the difference is slight. Besides, the flowers contain about five or six per cent. more water, and there is then more water to be transpired in the case of flowers and leaves, hence a larger loss is to be expected.

Hellriegel, as cited in Chemical News, No. 1336, says that when a plant begins to wilt it has already lost nearly half its water. This cannot possibly be so. I have observed the wilting of leaves after the loss of 6 per cent., and even less, from a total of 75 per cent. water. So, too, where some leaves of a plant are more exposed than others to the sun's action, they will wilt whilst the others are quite fresh looking. The plant cannot have lost much water. The transpiration withdraws water faster than it can be supplied to the leaf through its ducts.

University of North Carolina.

EXPERIMENTS TO DETERMINE THE EFFECT
OF A SOLUTION OF COMMON SALT, (NaCl),
AS A WASH IN DETERMINATIONS OF
"CITRATE INSOLUBLE" PHOSPHO-
RIC ACID, TO REPLACE PURE
WATER WASH.

F. B. DANCY.

The Association of Agricultural Chemists in convention assembled at Atlanta, Ga., in May, 1884, took tardy notice of a fact that had been doubtless for some time evident to most practical chemists, and this was, that the use of a solution of half citrate of ammonia solution (Sp. Gr. 1.09) and half water as a wash in determinations of "insoluble" phosphoric acid being equivalent to further treatment, was no longer admissible. The method then adopted by them prescribed pure water, at ordinary temperature, as the proper wash to be substituted for the citrate wash. This was eminently proper theoretically, and in many cases it proved satisfactory in practice. But at the same time when the method comes to be tested practically, it is found that in very many cases, if not in a majority, the

use of the water wash is found to be open to the very serious objection that it carries particles of the residue through the filter "as soon as the saline matters are extracted." The writer found this difficulty quite grievous, in fact in some cases (e. g., in case of bone ash, finely ground phosphates or "floats," and similar finely divided substances), this difficulty rendered analysis by the method well nigh impossible. The result is seen, furthermore, in almost all analyses of ordinary fertilizers by the dark ring on top the filtrate after the water wash has been applied. Others experienced the same practical difficulty. Prof. S. W. Johnson, of the Connecticut Experiment Station, met with it, and suggested that "probably the use of any indifferent saline solution, e. g., sodium chloride or sodium sulphate, as a wash liquid, would prevent this practical difficulty."

A solution of the best sample of Na_2SO_4 in the laboratory at the time gave me an acid reaction with litmus, due, doubtless, to impurities, and was abandoned. A solution of ordinary commercial NaCl (table salt) was then made, which was found to react neutral with either blue or red litmus.

I then determined to test the action of the NaCl solution, if any, on insoluble phosphate ($\text{Ca}_3\text{P}_2\text{O}_8$), by a few practical experiments. Want of time and pressure of other work made the investigation much less thorough than I would have desired, and the experiments far too few to have any very great weight. Yet I deem the results significant.

The solution of salt used was made by dissolving 200 grammes of commercial table salt in a litre of water, making a solution of about 1.11 spec. grav. (The solution upon test failed to reveal a trace of P_2O_5). The solution, as made, was stronger, I should judge, than was necessary, but was purposely so made in order to give it a fair trial. Also subsequently in the experiments the washing was prolonged so as to give the NaCl every opportunity to act.

The samples selected were:

- I. Orchilla Guano.
- II. Ammoniated Fertilizer.
- III. Acid Phosphate (from South Carolina Rock).

In the case of the orchilla one gramme was acted on by 100 c. c. ammonium citrate solution (sp. grav. 1.09 and neutral) on account of the large amount of so-called "reverted" phosphoric acid it contains. In each of the other two cases two grammes were acted on by 100 c. c. citrate solution as in ordinary practice.

When the water wash was applied it carried through a *small amount* of the residue in each case as usual, but it happened fortu-

nately that in *all* these instances the amount carried through was *very* slight (hardly enough in the worst case to make any appreciable change in the results), being most in the case of the ammoniated fertilizer, less in the case of the acid phosphate and least of all (almost absolutely none) in the case of the orchilla.

The mechanical effect of the NaCl solution, as a wash, was perfect, no particle whatever in either case passing the filter, and filtrates being consequently crystal clear.

Following are the results reached :

Orchilla	{ Water wash,	per cent. "insoluble," P_2O_5 ,	11.62
	{ NaCl wash,	" " " " "	11.75
Ammoniated Fertilizer	{ Water wash,	per cent. "insoluble," P_2O_5 ,	1.97
	{ NaCl wash,	" " " " "	2.25
Acid Phosphate	{ Water wash,	per cent. "insoluble," P_2O_5 ,	1.14
	{ NaCl wash,	" " " " "	1.16

While these results do not show that the NaCl solution has *absolutely no effect* on insoluble phosphate, yet they do show conclusively that if it has any effect at all it is so slight that it does not equal the loss by the water wash in three cases where the loss by the water wash was *unusually* small; being, for example, practically nothing in the case of the orchilla.

I am of the opinion that it has no effect on the insoluble phosphate whatever, certainly not enough to prevent its immediate and confident adoption as a substitute for water wash in all analyses. Be it observed also, in the above experiments, that the case of the greatest disparity in the results was the case where *most* of the substance passed the filter with the water wash. And in every instance the results from the water wash are observed to be smaller than the results from the NaCl wash.

N. C. Agricultural Experiment Station, March, 1885.

ON THE PRACTICAL QUANTITATIVE DETERMINATION OF SUGAR IN URINE.

JAS. LEWIS HOWE.

The following paper makes no pretence to originality, but merely aims to set forth practical results obtained by the writer in his work, and give a description of that method which experience seems to show the best for a physician's use.

Most physicians of ordinary ability are limited to a few simple qualitative tests for the presence of sugar in urine. The best are:

1st. Boiling the urine with strong caustic potash—a dark yellow or red color indicating sugar, the intensity of color being a very rough index of the quantity of sugar present. The addition of nitric acid to the solution causes the odor of caramel.

2nd. Adding to the solution, rendered alkaline by caustic potash or soda, a pinch of subnitrate of bismuth, which will turn black on boiling the solution if sugar be present.

3rd. Fehling's test.

It is often, however, of great advantage in diabetes mellitus to know with some degree of accuracy the quantity of sugar secreted, and to watch its daily fluctuations under treatment, and this few physicians, unless near a city laboratory, are able to do. At least one drug firm puts up compressed tablets of the ingredients of Fehling's solution, but these are unfortunately not to be depended on, as recently a case came to my notice in which these tablets failed to show any indication of sugar, though the secretion amounted to half a pound daily.

The following method presents the advantage of simplicity and expedition, the only apparatus required being a graduated glass, a burette, a porcelain dish two and a half to three inches in diameter, a glass rod and a spirit lamp.

The terms given are those of the metric system, since burettes are usually so graduated, but the results may be easily reduced to the English measure.

Fehling's solution as modified according to Liebreich:

3.46 grams copper sulphate crystals (which may be weighed by the druggist) are dissolved in a small quantity of water, about five cubic centimeters of pure glycerine added, sixty cubic centimeters of a solution of caustic potash of specific gravity 1.14,

and the whole diluted to 100 cubic centimeters. This solution should be prepared fresh every week.

10 cubic centimeters of the solution is brought to boil in a porcelain dish and urine added from a burette, until the last trace of blue has disappeared from the solution. If the urine contains so much sugar that less than three or four cubic centimeters precipitate all the copper, as is usually the case in diabetes mellitus, the urine should be diluted with nine parts water, and this $\frac{1}{10}$ solution used instead of the undiluted urine.

It requires .005 gram sugar to reduce each cubic centimeter of the Fehling solution. The following table indicates the number of grams sugar per litre urine for each number of cubic centimeters of the $\frac{1}{10}$ urine solution used to reduce 10 cubic centimeters of Fehling solution :

1 c. c. m. = 500 gram per litre.	16 c. c. m. = 31 gram per litre.
2 " = 250 " " "	18 " = 28 " " "
3 " = 167 " " "	20 " = 25 " " "
4 " = 125 " " "	22 " = 22.7 " " "
5 " = 100 " " "	24 " = 21 " " "
6 " = 83 " " "	26 " = 19 " " "
7 " = 72 " " "	28 " = 18 " " "
8 " = 62.5 " " "	30 " = 16.7 " " "
9 " = 55.5 " " "	35 " = 14.3 " " "
10 " = 50 " " "	40 " = 12.5 " " "
12 " = 41.7 " " "	45 " = 11 " " "
14 " = 36 " " "	50 " = 10 " " "

To reduce from grams per litre to grains per fluid ounce multiply by 1.8.

While adding the urine the Fehling solution should be kept at boiling point, but not allowed to boil. A gentle stirring facilitates the settling of the red oxide of copper.

To save time it is well to make a rough determination, first adding one to two cubic centimeters at a time, and then to make a second determination, adding at once nearly sufficient urine to cause complete precipitation and then add very slowly 'till the copper is accurately precipitated—a point which a little experience will exactly determine. Two such determinations can be easily made in fifteen minutes.

If it is desirable to work wholly in the English system, the following may be used :

70 grains copper sulphate, $1\frac{1}{2}$ fluid dram glycerine, 3 fluid ounces

caustic potash (sp. gr. 1.14)—diluted to 5 fluid ounces. Use 4 fluid drams of the Fehlings solution for each test.

20 minims	$\frac{1}{10}$	urine	=	240	grains	sugar	per	fluid	ounce.
25	"	"	=	192	"	"	"	"	"
30	"	"	=	160	"	"	"	"	"
35	"	"	=	138	"	"	"	"	"
40	"	"	=	120	"	"	"	"	"
45	"	"	=	100	"	"	"	"	"
50	"	"	=	96	"	"	"	"	"
55	"	"	=	87	"	"	"	"	"
60	"	"	=	80	"	"	"	"	"
70	"	"	=	69	"	"	"	"	"
80	"	"	=	60	"	"	"	"	"
90	"	"	=	53	"	"	"	"	"
100	"	"	=	48	"	"	"	"	"
120	"	"	=	40	"	"	"	"	"
140	"	"	=	34	"	"	"	"	"
160	"	"	=	30	"	"	"	"	"
180	"	"	=	27	"	"	"	"	"
200	"	"	=	24	"	"	"	"	"
240	"	"	=	20	"	"	"	"	"
280	"	"	=	17	"	"	"	"	"
320	"	"	=	15	"	"	"	"	"
360	"	"	=	13	"	"	"	"	"
400	"	"	=	12	"	"	"	"	"
440	"	"	=	11	"	"	"	"	"
480	"	"	=	10	"	"	"	"	"

Central University, Richmond, Ky.

A PRELIMINARY LIST OF ADDITIONS TO CURTIS'
CATALOGUE OF INDIGENOUS AND NAT-
URALIZED PLANTS OF NORTH CAR-
OLINA—FLOWERING PLANTS.

M. E. HYAMS.

RANUNCULACEÆ.

- Clematis cylindrica*, Sims. Virgins Bower.
Anemone cylindrica, Gray. Cylindrical-fruited Wind flower.
 acutiloba, Lawson. (Hepatica, L.) Sharp-lobed Hepatica.
Thalictrum purpurascens, L. Purplish Meadow Rue.
Ranunculus abortivus, L. Var. *Micanthus*. Gray.
 fascicularis, Muhl. Early Crowfoot.
 muricatus, L. Crowfoot.
 ambiguus, Watson. Should replace *R. alismæfolius*, Geyer.
Caltha palustris, L. Marsh Marigold.
Helleborus viridis, L. Green Hellebore.

PAPAVERACEÆ.

- Cheledonium majus*, L. Celandine. Adv. Eu.
Glaucium luteum, Scop. Yellow Horn Poppy. Adv. Eu.

FUMARICACEÆ.

- Dicentra Canadensis*, D. C. Squirrel Corn.

CRUCIFERÆ.

- Nasturtium armoracea*, Fries. Horse Radish.
Cardamine hirsuta, L. Var. *Sylvatica*. Small Bitter Cress.
Arabis dentatum, T. and Gr. Rock Cress.
Barbarea vulgaris, R. Br. Common Winter Cress. Nat. Eu.
Hesperis matronalis.
Brassica alba, L. White Mustard. Adv. Eu.
 nigra, L. Black Mustard. Nat. Eu.

VIOLACEÆ.

- Viola cuculla*, Ait. Var. *cordata*, Gray. Heart-leaved Violet.
 rostrata, Muhl. Long Spurred Violet.
 tricolor, L. Pansy. Heart's Ease.

CISTACEÆ.

- Lechea thymifolia*, Michx. Pinweed.
 tenuifolia, Michx. Small-leaved Pinweed. Canby, coll.
Hudsonia ericoides, L. Heath-like Hudsonia.

HYPERICACEÆ.

- Hypericum aurium*. St. John's Wort.
 drummondii. T. and Gr.
 buckleyis, M. A. Curtis. Canby, coll.

CARYOPHYLLACEÆ.

- Sagina procumbens*, L. Pearlwort.
Arenaria squamosa, Michx. Sand Wort.

MALVACEÆ.

- Hybiscus Trionum*, L. Bladder Ketmia. Adv. Eu.
Malva Sylvestris, L. High Mallow. Adv. Eu.

LINACEÆ.

- Linum striatum*, Walt. Winged Flax.
sulcatum, Riddell. Grooved Flax.
usitatissimum, L. Common Flax. Adv. Eu.

SIMARUBACEÆ.

- Ailanthus glandulosus*. Desf. Tree of Heaven. Adv. China.

ANACARDIACEÆ.

- Rhus aromatica*, Ait. Fragrant Sumac.

CELASTRACEÆ.

- Euonymus Americanus*, L. Var. *Obovatus*, T. and Gr. Strawberry Bush.

SAPINDACEÆ.

- Aesculus glabra*, Willd. Fœtid Buckeye.

POLYGALACEÆ.

- Polygala cruciata*, L.
Curtisii, Gray. Canby, coll.

LEGUMINOSÆ.

- Medicago sativa*, L. Lucerne. Adv. Eu.
Lespedeza striata, H. & A. Japan Clover. Canby, coll.
Desmodium paucifolium, D. C. Lick-Treefoil.
rotundifolium, D. C.

ROSACEÆ.

- Prunus maritima*, Wang. Beach Plumb.
Geum Virginianum, L. White Avens.
Potentilla tridentata, Ait. Cinqfoil.
Fragaria vesca, L. European Strawberry—Wild Strawberry.
Rubus candensis, L. Dewberry. Low Blackberry.
Amelanchier Canadensis, L. Var. *Botryapium*. T. and Gr.

ONAGRACEÆ.

- Jussiaea pilosa*, H. B. K. Canby coll.
Hyppuris vulgaris.

CRASSULACEÆ.

- Sedum acre*, L. Mossy Stone Cross.
nevii, Gray.
Rhodila, L. Canby, coll.

SAXIFRAGACEÆ.

- Philadelphus inodora*.

UMBELLIFERÆ.

- Coriandrum sativum*, L. Adv. Eu.
Fœniculum vulgare, Gærtn. Adv. Eu.

Osmorrhiza brevistylis, D. C. Hairy Sweet Sicely.
longistylis, D. C. Sweet Sicely.

CAPRIFOLIACEÆ.

Viburnum cassinoides, L. Canby, coll.

COMPOSITÆ.

Elephantopus nudatus, Gray. Canby, coll.

Aster surculosus, Michx. Var. *ericoides*, (?)

do Michx. Var. *gracilis*. Gray.

ericoides, L. Var. *Villosus*.

Erigeron quercifolium, Lam.

Solidago bicolor, L. Var. *concolor*, T. and Gr. Canby, coll.

Calendula asteria. Introduced.

Acanthospermum xanthoides, D. C. Adv. S. A.

Eclipta procumbeus, Michx.

Rudbeckia triloba, L. Var. *impestris*. Canby, coll.

do Var. *humilis*. Canby, coll.

Coreopsis senefolia, Michx. Var. *Stellata*.

do Michx. Var. *auriculata*.

Centaurea solstitialis, L. Star Thistle. Introduced.

Cirsium arvense, Scop. Canada Thistle. Adv. Eu.

Cichorium intybus, Tourn. Common Chicory. Adv. Eu.

ERICACEÆ.

Rhododendron Vaseyi, Gray. Magnolia.

Leiophyllum buxifolium, Ell. Var. *prostratum*, Gray.

Schweinitzia odorata, Ell.

AQUIFOLIACEÆ.

Ilex mollis, Gray.

PRIMULACEÆ.

Lysimachia nummularia, L. Money work. Adv. Eu.

lanceolata.

asperulifolia.

LENTIBULACEÆ.

Pinguicula Pumila, Michx. Canby, coll.

SCROPHULARIACEÆ.

Chelone obliqua, L. Canby, coll.

Penstemon, *Digitalis*, Nutt.

Gerardia lævigata, Raf.

ACANTHACEÆ.

Dipteracanthus ciliosa. Nees.

VERBENACEÆ.

Verbena striata.

bracteosa.

LABIATÆ.

Mentha piperata, L. Var. *subhirsuta*.

Thymus serpyllum, L. Creeping Thyme. Adv. Eu.

Monarda clinopodia, L. Canby, coll.

Pycnanthemum Torreyi, Benth. Mountain Mint.

HYDROPHYLLACEÆ.

Hydrophyllum umbellatum.
appendiculatum, Michx.

SOLANACEÆ.

Physalis pubens.

CHENOPODIACEÆ.

Chenopodium, Bonus-Henricus. Good King Henry.
Salicornia herbacea, L. Var. *aquatica*. Saltwort.

AMARANTACEÆ.

Amarantus hypochondriacus, L. Adv. Tropical America.
melancholicus, L.

EUPHORBIACEÆ.

Euphorbia capparis. Spurge.

SALICACEÆ.

Salix purpurea, L. Purple Willow.
longifolia, Muhl. Long-leaved Willow.
Populus tremuloides, Michx.
monolifera, Ait.
balsamifera. Var. *candicans*. Balm of Gilead.

CONIFERÆ.

Abies balsamea. Marshall.
Juniperus communis, L. Common Juniper. Rare.
Thuja Caroliniana, Engelm.
Taxus baccata, L. Var. *candicans*, Gray. American Yew.

ARACEÆ

Calla palustris, L. Water arum.
Symplocarpus racemosus, Michx.

NAIADACEÆ.

Potamogeton pusillus, L. Pondweed.

ALISMACEÆ.

Sagittaria lancifolia, L. Arrowhead.

ORCHIDACEÆ.

Corallorhiza multiflora, Nutt. Coral Root.
Spiranthes simplex, Gray. Ladies Tresses. Canby, coll.

AMARYLLIDACEÆ.

Hypoxis juncea, Smith. Star Grass. Canby, coll.

SMILACEÆ.

Smilax herbacea, L. Carrion Flower.
Trillium recurvatum, Beck.

LILIACEÆ.

Asparagus officinalis, L. Garden Asparagus. Nat. Eu.
Erythronium albidum, Nutt. White Adder's Tongue. Canby, coll.
Ornithogalum umbellatum, L. Star of Bethlehem.
Lilium Grayi, Watson.

JUNCACEÆ.

Luzula Carolinia, Wats. Wood.rush. Canby, coll.

GRAMINEÆ.

Leersia hexandra, Swartz. McCarthy, coll.

Sporobolus cryptandrus, Gray.

Muhlenbergia sylvatica, T. and Gr. Chapman's supplement.
glomerata, Trin.

Deyeuxia Canadensis, Beauv.

Triodia ambigua, Benth. (*Tricuspis ambigua*, Chap.)

Poa brevifolia, Muhl.

sylvestris, Gray.

alsodes, Gray. Canby in Chapman's suppliment.

Glyceria obtusa, Trin. McCarthy, coll.

Eragrostis campestris, Trin. (*E. nitida*, Chapman.)

Festuca ovina, L. Probably introduced.

Bromus steritis, L. Probably introduced.

racemosus, L.

Hordeum pratense, Huds. Probably introduced.

Elymus Canadensis, L.

Lolium perenne, L. Probably introduced.

Ajra caryophylla, L. Probably introduced.

Danthonia compressa, Anst. Chapman's suppliment.

Hierochloa borealis, R. and S. Vanilla Grass. Rare.

Paspulum purpurascens, Ell. McCarthy, coll.

Anthænantia rufa. Benth. McCarthy, coll.

Panicum serotinum, Michx. Chapman's suppliment.

agrostoides, Spreng. Chapman's suppliment.

consanguineum, Kunth. Chapman's suppliment.

laxiflorum, Lam. Chapman's suppliment.

verrucosum, Muhl.

Setaria viridis, Beaur.

Cenchrus inurtus, M. A. Curtis. Chapman's suppliment.

Andropogon argyræas, Schultz.

Erianthus striatus, Bald.

contortus, Ell.

Agropyrum repens, Beauv. (*Triticum repens*, L.)

SOME ATTEMPTS AT FORMING HEPTYL-
BENZOL.

F. P. VENABLE.

Whilst examining the compounds of the heptane obtained from *Pinus Sabiniana*, the possible preparation of this homologue of benzol gave promise of an interesting research. This body would be isomeric with the dimethyl-isoamyl benzol prepared by Fittig, (*Annalen*. 141, 168), from bromxylol, isoamyl bromide, sodium and ether and the methyldipropyl benzol prepared by action of sulphuric acid upon a mixture of acetone and methylnormal-propylketone.

The method of Fittig and Bigot was followed in the following experiments: Pure brom. benzol (20 grm.) was mixed with 22 grm. heptyl bromide and 8 grams of freshly cut sodium. To the whole was added about an equal volume of absolute ether. The ether was dried by standing over sodium, and then distilled over sodium. This mixture was allowed to stand, showing very little action at the end of a day or so. A reflux cooler was then attached, closed by a chloride of calcium tube, and the whole heated on a water bath for one day. The ether was then distilled off and the remainder fractionated. A portion coming over at a lower temperature was not examined, but consisted doubtless of heptylen and unaltered ingredients of the mixture. A portion easily solidifying gave, on rough determination, the melting point 64°C , and proved to be diphenyl. A very small portion boiled over 300°C , but it could not be gotten pure enough nor in sufficient amounts for a closer examination.

Again, as the iodide seemed much more capable of reacting than heptyl bromide, it was substituted in a second experiment; 15 grams heptyl oxide, 15 grams bromide benzol, and 6 grams of sodium were taken, an equal volume of absolute ether added and the mixture allowed to stand. The action was much more marked in this case, and after standing about 24 hours, it was heated 2 hours on the water bath filtered, with the addition of some ether, the latter distilled off and the residue fractionated. The product seemed to be mainly of low boiling point and diphenyl. A small portion boiling 225° and 238°C , was saved for analysis, but on standing it deposited so much diphenyl as to make further examination useless.

It is probable that the body sought was formed along with the

diphenyl, but in very small amounts, neither heptyl iodide nor bromide yielding it in sufficient amounts for further work. The waste of the heptane in these processes prevented a continuation of the research.

ATTEMPTS TO FORM MERCUROUS HYPOPHOSPHITE.

E. A. de SCHWEINITZ.

1°. A solution of pure sodium hypophosphite when added to a solution of mercurous nitrate gave a white precipitate, which quickly became yellow, brown and finally black. This action or change could not be prevented, and hence the character of the precipitate was not determined. 2°. Freshly precipitated mercurous oxide was treated with hypophosphorous acid at a low temperature and in the dark, but the acid merely acted as a reducing agent, metallic mercury being formed. The acid was prepared by heating phosphorus with barium hydroxide solution, the barium hypophosphite decomposed carefully by diluted sulphuric acid and the acid concentrated. 3°. A solution of sodium hypophosphite was added to a solution of mercurous nitrate, the latter in excess, with sufficient water to dissolve most of the hypophosphite formed, the liquid quickly filtered in the dark and the filtrate caught in a vessel surrounded with a freezing mixture. This filtrate then yielded white needle-like crystals. These were partially dried on a watch glass, under the receiver of an air pump, the light being carefully excluded, and were then analyzed. The results obtained were, Hg. 74.72, P. 10.84 per cent. Supposing the formula for mercurous hypophosphite to be $\text{Hg}_2(\text{Hg}_2\text{PO}_2)_2$ the calculated per cent. of mercury and P would be, Hg. 75.47. P. 11.69,—nearly the same proportion as found by analysis in the supposed mercurous hypophosphite. As the crystals could not be completely dried without decomposition, the difference in the actual per cent. and that as calculated was due to water. Want of time prevented the determination of water, but the results as obtained point to the formation of the desired salt. The crystals were difficultly soluble in water, hence they could be obtained by crystallization at a low temperature.

DISTRIBUTION AND CHARACTER OF THE EOCENE DEPOSITS IN EASTERN NORTH CAROLINA.

W. C. KERR.

In the report of the writer on the Geology of North Carolina, published in 1875 (Geology of N. C., Vol. I, pp. 149 and 150) the exposures of eocene deposits in eastern North Carolina are stated to be confined to a few outcrops along the banks of streams between the Neuse and Cape Fear rivers, and outside this area two small patches capping hills—one in Wake and the other in Harnett county, (incorrectly Moore Co. in report). Over the larger part of this area the eocene (Testiary) deposits were described in the text (p. 156) and represented on the geological map accompanying the report as being covered over (if they exist there at all) by the sands, gravel and clay of the Quaternary. It was suggested in that report, (p. 150), however, that the eocene caps on the hills of Wake and Harnett counties showed these deposits to have had at one time a vastly greater horizontal extent than at present. And this view has been confirmed by observations made in Harnett, Moore and adjacent counties during the winter of 1883-'84. These with other recent observations lead the writer to the conclusion that not only the isolated fossiliferous patches capping these few hills, but also that the surface deposits over this section of the State, between the Neuse and Cape Fear rivers, are eocene and not Quaternary, as was formerly supposed. The facts which lead to this conclusion are brought out in this paper.

The patch of eocene rock capping a hill in Wake county is to be found 7 miles east of Raleigh, near the railroad, at an elevation of about 350 feet above sea level. The rock is a shell conglomerate, 6 to 10 inches thick, covering two-third acres in extent. Fossils collected from this rock were identified as eocene by Conrad several years ago. The other of these caps mentioned is situated near Spout Springs, a station on the Cape Fear and Yadkin Valley Railway, in the southern part of Harnett county, on an elevated sandy ridge or small plateau, elongated in a nearly north and south direction, between Upper and Lower Little rivers. Capping a part of this sand ridge is a nearly or quite horizontal layer, 3 feet and more in thickness, of a light, porous or spongy chalk rock, white and brown colors, containing many prints of shells and echinoderms—a

rock to some extent used in building in that immediate locality. In places this rock is replaced by a brown ferruginous sandstone $2\frac{1}{2}$ to 3 feet thick. A third of these patches, and in many respects the most interesting of them, is one which occurs near Manly, a station on the Raleigh and Augusta Air-line Railroad in Moore county, on top of an elevated hill known locally as Shaw's Ridge. Capping this ridge in places, at an elevation of more than 500 feet above sea level, is a rather soft, porous, chalky rock, containing the same eocene fossils which characterize the patches of Wake and Harnett counties, underlaid with sands and clays. At one place (locally known as "Paint Hill") this layer of rock is a spongy limestone, with a thickness of 2 feet, containing eocene fossils. Under this comes 5 to 6 feet of clay, laminated, shaly. Under this latter 2 feet of sand containing pebbles and petrified wood, and this last in turn is underlaid with brown sand and clay, irregularly bedded, of unknown thickness.

The discovery of eocene fossils in the rock capping the last mentioned of these hills is of special importance, on account of the fact that the railroad cut passing through a portion of this ridge exposes to view some of the beds underlying the fossiliferous layer of rock capping the ridge. These beds are made up of clay, sand and gravel, almost always irregularly bedded, and often showing as fine an example of the flow and plunge structure as it has been the writer's good fortune to see. These underlying beds are wanting in fossils, so far as observation has shown. In every respect they are similar to beds exposed in railroad cuts at places along the Raleigh and Augusta Air-line Railroad, for several miles, both south and north of Manly, and along the Cape Fear and Yadkin Valley Railway, between Sanford and Fayetteville; and further, these Manly beds bear so close a resemblance to the sand and gravel deposits exposed along the bluffs of the Cape Fear river, below Fayetteville, both in character of materials and in character of bedding—flow and plunge structure—that, following the railroad from Manly to Fayetteville, and then the deposits along the river banks below Fayetteville, one is driven to the conclusion that these are all approximately of the same age. And hence, that these irregularly bedded deposits of sand and gravel which are exposed along the bluffs of the Cape Fear river for a number of miles below Fayetteville, resting on the cretaceous below, belong properly to the eocene, and do not represent the orange sand of Hilgurd, as was formerly believed. (Kerr's Geol. of N. C., 1875, p. 155). This conclusion has in like manner been extended so as to include the beds of earth, gravel and shingle, cap-

ping quite a number of hills in Harnett, Moore, Richmond, Anson and other counties. Indeed, between the tributaries of the Neuse and Cape Fear rivers it may be stated with regard to these deposits, that everything within these limits is eocene except a few small patches of miocene and two of Quaternary—one of the latter 12 miles below Wilmington, on the east side of the Cape Fear, and the other 10 to 15 miles below New Berne, on the Neuse river—and to a large extent doubtless the intervening coast formation is quaternary and recent. The exact northern limit of the eocene exposures in the State is not now definitely known, but somewhere between the Neuse and Tar rivers the eocene becomes covered up by miocene deposits, probably continuing northward under the latter. The rock underlying the town of Washington, at a depth of 20 feet, and forming the bed of Pamlico river as far as 10 miles below that town, is eocene. Southward the writer believes the eocene formation to be continuous or nearly so across the States of South Carolina and Georgia, into Florida; and that hence in the geological map of the south Atlantic region an extensive area which heretofore has been colored to represent quaternary surface deposits should be changed to eocene.

The character of eocene deposits over different portions of North Carolina, where they occur, differs considerably. Capping many of the hills along the western border where the more recent formations meet and overly the older archæan or triassic rocks, as in Harnett, Moore, Richmond and Anson counties, these deposits, varying from a few feet to 15 or 20 feet in thickness, show at many places every variety of irregular bedding—beach structure, &c.,—and at other places no bedding at all, fine and coarse material being generally commingled. In some of these places the hills and hill sides for a considerable distance are covered with a layer of quartz pebbles varying from quite small to several inches in diameter—doubtless the finer materials which once may have been mingled with these having been since washed away. The best exposures of the beach structure are to be found, as mentioned above, along the Raleigh & Augusta Air-line Railroad in Moore county. The materials are here mainly clays and sands of various colors, alternating, or at times mixed. There are also some good exposures along the Carolina Central Railway through Robeson and Richmond and Anson counties. Here toward the east the deposits in some places consist almost entirely of clay, of gray, purple and other colors, sufficiently pure to be used for brick or potter's clay. At other places irregular layers of clay and sand alternate, and again the deposit is entirely of

sand. Towards the western limit the sand becomes coarser, and near the western border will be found the patches of coarse pebbles. The elevated patches occurring in Wake, Harnett and Moore counties, as well as those along the banks of Cape Fear below Fayetteville, have been mentioned already. As exposed at other places these deposits consist of a light colored and yellowish consolidated marlyte, as in the steep bluffs on the Neuse, 10 miles below Goldsboro, and again 15 to 20 feet thick, 10 miles above New Berne, and in the natural wells near Magnolia, containing in this form 40 to 80 per cent. of carbonate of lime; or of a shell conglomerate as seen about New Berne and 8 or 10 miles up the Trent river—a rock much used for building in New Berne, and burned for lime, while in some limited localities it is made up of siliceous casts of shells from which all the carbonate of lime has been dissolved, constituting a true bushstone; or of a white calcareous sandstone more or less compacted, as on the Neuse, near Goldsboro, and near the railroad through Duplin and Sampson counties, and in Onslow and Jones, on the Trent, and along the North East river for the most part of its course to within a mile of Wilmington; or of a gray and hard limestone, as about Richlands, in Onslow, at Rocky Point, 20 miles north of Wilmington, and 7 miles north, on the North East river; or of a coarse conglomerate of worn shells, shark's teeth and fragments of bones and stony pebbles, as in the upper part of Wilmington and at Rocky Point; or of a fine shaly infusorial clay, light gray to ash colored, as in Sampson county, near Faison's depot. (Geology of N. C., 1874, pp. 146 and 150).

In the limestone rock occurring at Rocky Point and Castle Hayne, there is to be found, a few feet below the surface, irregular layers (somewhat in pockets) of gray limestone conglomerate, from 0 to 3 feet (and even 4 or 5 feet at the latter) in thickness, from $\frac{1}{4}$ to $\frac{1}{2}$ and even $\frac{1}{2}$ of the rock being made up of black, greenish or gray irregularly rounded phosphatic pebbles, varying in size from quite small to 1 and 3 inches in diameter. It is probable that, at least in some cases, the larger, irregular perforated masses of phosphate rock weighing from 2 to 50 pounds, recently discovered in Duplin and Sampson counties,* also belong to the eocene, but the exact age of these is yet undetermined.

The acceptance of the conclusion adopted in this paper, that the

* See Dabney, C. W.—This journal, 1883-'84, pp. 64, 68.

Rept. of N. C. Agr. Ex. Sta., 1884, pp. 44, 89.

Phillips, W. B. - North Carolina Phosphates; Sept., 1883, pp. 19, and this journal, 1883-'84, pp. 60, 63.

superficial deposits in the southern half of the eastern region of North Carolina, and probably of the Atlantic slope southward, are generally eocene and not quaternary, will necessitate the re-writing of the quaternary as well as the eocene geological history of this region. The unquestioned quaternary deposits of North Carolina are now confined to a few counties in the northeast region of the State, especially in the vicinity of Weldon, (Halifax county), on the Raleigh & Gaston Railroad, at an elevation of less than 100 feet, and along the coast region where the quaternary merges into the modern deposits. And these quaternary gravel beds of the Weldon region are underlaid by fossiliferous miocene deposits. Admitting that the superficial deposits of clay, sand, gravel and shingle capping the hills as about Carthage, in Moore county, Rockingham, in Richmond, and Wadesboro, in Anson county, some of which have an elevation of from 300 to 500 feet above tide water are eocene, it is clear that during this epoch there was a submergence of that region, so that the eocene seas extended inland from 100 to 150 miles west of the present coast line, and covered many of the hills along the eastern margin of what we now call the hill country or middle section of the State. And these eocene deposits covered up during this time the underlying cretaceous, a considerable part of the triassic, and a broad area of archrean rocks. But the absence of quaternary deposits from this region leaves us wanting in evidence that there was any re-submergence of this region during the champlain epoch, or at any time subsequent to the eocene. However, the quaternary gravels in the Weldon region, of an elevation of something less than 100 feet above tide water, show a depression there during some part of that period; and the existence of quaternary shell deposits in the present seacoast region, a few feet above tide water, as on the Neuse and Cape Fear rivers, shows, of course, a subsidence of this region while these deposits were being made. There is also evidence of past eocene submergence of that region of the State nearer the coast in the fact that the eocene limestone rock at both Rocky Point, near the present banks of the Northeast Cape Fear river, and at Magnolia quarry, on the Cape Fear river, about 12 miles above Wilmington, has its surface extensively and irregularly eroded. Pot-holes in the surface of these deposits are numerous and large. But there is no evidence that this submergence extended very far west in the southern portion of the State.

Following the extended eocene submergence of the South Atlantic slope, was a gradual re-elevation. The numerous exposures from the extreme western margin eastward for a considerable distance

below Fayetteville, on the Cape Fear, exhibiting the irregular bedding of beach structure, go to prove that the re-elevation went on gradually. This re-elevation went on slowly, and during this time the coast line was being extended eastward by materials washing down from the adjacent coast, and being piled up by wave action in doubtless much the same way as this process is going on at the present time. Furthermore, while this elevation was going on, conditions were changing from those of the eocene to the miocene time, and the patches of miocene deposits, perhaps at one time more extensive than they now are, were laid down on top of the eocene beds. As this elevation continued to go on up to and through the glacial epoch, the rivers were cutting their channels through the miocene eocene and the underlying cretaceous rocks.

It is probable that the elevation of the Cape Fear region during the quaternary, was considerably greater than it is at the present time, since at a point a few miles above Wilmington the bottom has been grooved down about 100 feet below the present sea level; and the river at this point was probably not less than two miles wide. With the coming on of the champlain epoch, there was a resubmergence of the northern portion of the State, as the region about Weldon, to the extent of probably 200 feet, allowing the deposit of the quaternary gravels on the hills of that section. In the Cape Fear section there is no evidence at hand that the subsidence which took place during the champlain was much more than sufficient to bring the land surface to about its present position. It is probable, however that the surface did sink below its present level, and that during this time the extensive alluvial deposits about the river in the region of Wilmington, were formed by deposits from the river, and that a re-elevation of this region to the present level took place during the passage of time from the champlain to modern.

AMMONIA IN SALIVA.

MAX. JACKSON.

That ammonia does occur in human saliva has been shown by Mallet and Heyward (*Chemical News*, No. 1144). The mode of testing was to place at the bottom of a perfectly clean and dry test-tube a small quantity of saliva; a little magnesium oxide was then added, a slip of filtering paper moistened with the Nessler reagent suspended in the upper part of tube, then corking and exposing to a temperature of 30°C. The amount found varied with different persons and according to the experiments the "sole or chief source is not found in the free gas, in the expired products of respiration merely condensed in aqueous solution in the mouth." This was deduced from an examination of the saliva coming directly from the different glands.

As a verification of this deduction, experiments are here cited made on the same person at various times and under varying circumstances. Tobacco smoke has been stated to contain ammonia, and hence special reference was had to the use of tobacco.

The experiments were carried out precisely as above.

1° EXPERIMENTS MADE WITHIN AN HOUR AFTER EATING.

not smoking,	120 m. g.	120 m. g.	140 m. g.	160 m. g.
after smoking,	120 m. g.	120 m. g.	100 m. g.	120 m. g. 100 m. g.

2° EXPERIMENTS MADE FROM ONE TO TWO AND A HALF HOURS AFTER EATING.

not smoking,	120 m. g.	100 m. g.	100 m. g.	120 m. g.	140 m. g.
after smoking,	120 m. g.	60 m. g.	60 m. g.	120 m. g.	

3° EXPERIMENTS MADE FROM THREE TO FIVE HOURS AFTER EATING.

not smoking,	1.40 m. g.
after smoking,	90 m. g. 100 m. g. 120 m. g. 110 m. g.

4° EXPERIMENTS MADE TEN HOURS AND MORE AFTER EATING.

not smoking,	100 m. g. 120 m. g. 120 m. g.
--------------	-------------------------------

In 1° the average for not smoking is 135 m. g.; after smoking it is 112 m. g. In 2° the averages are, respectively, 116 m. g. and 90 m. g. In 3° there is only one experiment, giving 140 m. g.; after smoking the average is 105 m. g. In 4° the average is 113 m. g.; no experiments were made after smoking under this heading.

From this one would deduce that the total amount of ammonia is sometimes very decidedly affected by such things as smoking, the food taken, &c., yet the main supply is evidently from some other source.

Just why smoking should decrease the amount of ammonia in the saliva is not very apparent, but from the above experiments such seems to be the result. The amount of ammonia decreases, too, the longer the time that has elapsed since food was taken. The one experiment under 3° cannot be taken as contradicting this, as it stands alone.

From the paper above quoted the amounts of ammonia vary greatly with different persons. All of these experiments were made upon the same person.

Chemical Laboratory, U. N. C.

NOTES ON THE GEOLOGY OF THE REGION ABOUT TAMPA, FLORIDA.

W. C. KERR.

The observations embodied in the following notes were made by the writer at such intervals as his broken health permitted, during the spring of 1884. The notes are fragmentary and incomplete, but are now given to the public with the hope that they may contribute something, however little, to a subject that is in need of contributions. A good resumé of what is known concerning the more general subject of the geology of Florida has been given by Smith, in the American Journal of Science for April, 1881 (Vol. XXI, pp. 292 *et seq.*). The writer's observations confined mainly to the region about Tampa, confirm the conclusions of Conrad (Am. Jour. of Sci., II, Vol. II, pp. 30 *et seq.* and later of Toumey (same journal II, Vol. XI, pp. 390 *et seq.*), to the effect that the limestone rock underlying the superficial sands of this region, and outcropping along the banks of streams, shore line, &c., is to be classed with the upper eocene. And in the following notes the limestone rock described as underlying the superficial deposits, is believed to belong to the eocene in every case.

On the west side of Hillsboro Bay, at a point 3 miles south of Tampa, and for a distance of half a mile along the shore, there is exposed a partly compact and partly semi-compact rock, rising from 6 to 10 feet above tide level and shelving down under the water's surface. This rock is generally a dirty, whitish silicified rock, occasionally soft, while at other places it is more compact, hard and

occasionally chalcedonic, with weathered, imperfect forms of fossil shells. Usually, however, there are no fossils to be seen. Occasionally the rock is shaly, especially near the upper part of the bed. It is overlaid by an irregular deposit of gray to blueish colored clay, which near the shore has a thickness of one to six feet, or in wells at some distance back, ten to twenty feet above tide. The land near the shore has, then, an elevation of 12 to 14 feet above tide water. Back from shore line, 50 to 200 yards, it rises to an elevation and twenty feet; and the surface, varying from level to undulating, slopes from this point down toward old Tampa Bay.

At a point on the shore above the one just described, and $1\frac{3}{4}$ miles below Tampa, below and for three to four feet above tide level are to be seen quite a number of rough, irregular masses of marly limestone, occasionally quite marly, and imbedded irregular masses of chalcedony.

At Ballast Point, five miles south from Tampa, the underlying limestone rock is cellular, soft and contains large quantities of eocene shells. In thickness it extends from an unknown depth below the water surface to three or four feet above. Here the point itself, and a series of small points jutting out along the shore for a distance of several hundred yards, are covered with numerous lumps and irregular geodic, strangely shaped masses of chalcedonic fossilizations of limestone fragments, large coral stems and shells.

Along Six Mile Creek, which runs into Hillsboro Bay at a point east from Tampa, there are several good exposures of the eocene rock. At Bunchville, where the railroad crosses the stream, six miles east from Tampa, and for three-quarters of a mile downward, the channel of the creek is narrow and tortuous, with steep rocky banks. The water for one-quarter mile is shallow and the bottom covered with blocks of limestone, while further down stream the water becomes deeper and the channel gradually widens. The bottom is hard, solid rock, (presumably the same eocene limestone) out to the Bay. The cliffs are vertical, or nearly so, rugged, with limestone rock extending up five to seven feet above water level, and overlaid with three to five feet of sand, or sand with marl or clay. The rock is full of imperfect shell prints at water level, and for a few feet above. Nearer the upper surface it becomes a more soft, lumpy white limestone, containing numerous shell prints. In places in this limestone occur large blocks of chalcedonic quartz, of dark, yellow and gray colors. The soft white limestone just below the railroad bridge hardens on exposure, and would hence make a useful building stone.

In the irregular water-worn depressions on top of this limestone rock, in the vicinity of Six Mile Creek, and underlying the superficial sands, occur frequently beds of post pliocene shells, unmixed with the sand or clay, and generally unbroken. These in a few places are found near water level, but more generally they are to be found at an elevation of two to seven feet above tide water. Above the railroad bridge the creek narrows to a small brook, crooked, with a bottom of shell rock, and this rock extends up into the high cliffs, ten to fifteen feet. On top of it there can be found detached beds of post pliocene remains.

On Alefia river, east side of Hillsboro Bay, and a few miles distant, under the bridge, the bottom and banks, to a height of three to four feet are of limestone rock, which in the bed of the stream shelves out across the river and produces a series of rapids. The rock is a rough coralline and conglomerate-coprolitic limestone, containing many fragments of bone and small sharks teeth, much whitish, yellow and dark chalcedony, large blocks of silicified coral and oyster shell. There is also much coprolitic gravel with sharks teeth and bones gathered along the shore in heaps, drift. Three-fourths of a mile below the bridge the rock at water contains a layer six to eight inches thick of silicified shell rock, (coquina), and under this is a soft light colored sandy marl, half compacted with black coprolitic grains.

Near Bloomingdale, half mile south, is a lime-sink, 45 feet deep by 250 feet wide. A section down through the sides of this shows, going downward, for first 15 to 20 feet from top, brown and gray sand; then 10 feet of brown sand with marly lumps, and calcareous gravel with patches of marly clay; then marl, light colored, sandy, with black phosphatic gravel at 30 to 35 feet; below this comes a whitish limestone in irregular masses, more or less silicified and converted to a calcareous sand rock.

At Bradentown, on Manatee river, five miles from its mouth, the bluff, fifteen feet high, is sandy; but five miles further up the river at Rocky Bluff, on north side, it consists of a yellowish white, rough, weathering, siliceous limestone, extending five to six feet above tide level, and visible one to two feet below water surface. The rock, here, is shelving, cavernous; one-fourth mile down the river the rock is visible at low tide, shelly and soft.

Near Col. Forester's orange farm, four miles up the arm of a creek, from Bradentown, the rock is visible in banks of creek for half mile two to three feet above high tide water, and exists also in bed

of stream. It is a compact, whitish eocene limestone, with fragments and shell prints.

Near Bartow the rock, as exposed in ravines, gullies and springs is generally soft, light, cellular, whitish; while in places it is compact, fragmentary conglomerate, containing iron sand. Rock near Bartow is used in building of chimneys, &c.

At Fort Meade rock is to be found in bed of Peace creek, and on right bank is exposed in high bluff of 30 to 40 feet above water level. It is a dull white calcareous agglomeration of rounded (or ovoid) gravel, particles one-tenth to one-half and occasionally one inch long by one-quarter inch shorter diameter, white and compact, with small sharks teeth, worn fragments of shells, spines of echini and bits of bone. This resembles quite closely the phosphatic conglomerate of Alefia river. Above this calcareous rock occurs a sandy calcareous loam, with gravel and angular fragments of the calcareous rock three to four feet thick.

At several places along the west shore of Hillsboro Bay, as near mouth of Alefia river, the water is encroaching upon the land, as can be seen by the fact that the banks are low and trees are now to be seen growing out beyond the high land in the region now partly flooded with salt water, showing probably that a subsidence of the coast is now in progress. And there is additional evidence of this in the fact that near the mouth of this and other streams, the eocene limestone rock in the beds of the streams has been eroded out to a depth below which any erosion appears to be going on at present time. When the coast was more elevated than now, these channels were worn out by action of river water.

The fact, however, that the post pliocene marl deposits lie on top of the eocene lime rock, in depressions worn out by action of water, goes to show that at a time prior to the deposition of these patches of marl, the level of this eroded surface must have been lower than at present; and at time these deposits were made the surface must have been of course below tide level.

The conclusions which the writer draws from the facts brought out by these observations, are: (1), the limestone rock underlying the region of country about Tampa belongs to the upper eocene as already pointed out by Conrad & Toumey. And as a gentleman of intelligence who visited Fort Myers, informed the writer, that the rock at that place was both in appearance and in fossils, similar to that about Tampa, the eocene limestone rock almost certainly extends at least as far south as that point. (2.) In order to have produced the existing condition of affairs about Tampa Bay, an erosion

of the eocene surface rock, while at or near tide level, was followed by a submergence, at which time the post pliocene deposits along near the shore were made; following this was a re-elevation to a point higher than that of present time by probably at least six to seven feet, and now, as pointed out above, the re-subsidence appears to be in progress.

SOLUBILITY OF BARIUM CHROMATE.

J. F. WILKES.

The proposition has frequently been made to determine barium as chromate, and to separate barium from strontium and calcium, by means of potassium bichromate. Meschezerski (*Zeit. Anal. Chem.*, 21, 399) enumerates several objections to the method, as the difficultly soluble nature of strontium chromate, the solubility of barium chromate, and its tendency to carry down foreign salts with it.

A few experiments were undertaken to further test this matter. Solutions were prepared, one of BaCl_2 , (1 c. c. = .0222 Ba), SrCl_2 (saturated), $\text{K}_2\text{Cr}_2\text{O}_7$, (1 c. c. = .03167, $\text{K}_2\text{Cr}_2\text{O}_7$, and 1 c. c. = .3167). The barium solution and chromate solution were mixed in varying proportions in a flask which was corked and shaken three or four times a day for about four days. The flasks stood in a room of fairly equable temperature, (about 15°C). The contents were then filtered, 50 c. c. taken, and both barium and chromium sesquioxide determined in duplicate. These experiments related simply to the solubility of barium chromate and strontium chromate. No mixture of the two was made nor attempt at separating them.

In three experiments it was found that where 4.50 grams of potassium bichromate were present per litre, .434 grams of barium chromate were held in solution; with 11.06 grams $\text{K}_2\text{Cr}_2\text{O}_7$, there were .278 grams BaCrO_4 ; with 20.10 grams $\text{K}_2\text{Cr}_2\text{O}_7$, there were .192 grams BaCrO_4 . This would go to prove that the stronger the solution of potassium chromate used, the more complete is the precipitation of barium.

To obviate the difficulty about the insolubility of strontium chromate, some have recommended the addition of a little acetic acid as dissolving the strontium without affecting the solubility of the barium. By the addition of less than one per cent. of acetic acid,

the amount of barium chromate held in solution was [doubled. Larger amounts, up to 7.5 per cent. did not very notably increase this amount held in solution. Obviously, then, acetic acid increases the solubility of the barium too much to be used in the separation. Hydrochloric acid greatly increases the amount of barium held in solution.

Ammonium chloride, added to the potassium bichromate solution, makes it capable of dissolving or holding in solution much more barium chromate. In our experiment the amount held in solution was more than five times as great as it should have been.

Sodium acetate in the proportion of about five grams to the hundred cubic centimeters of liquid, prevents any of the barium from being held in solution. On taking 50 c. c. of the filtrate from this mixture, no precipitate was gotten with sulphuric acid, showing the almost absolute absence of barium. The same proportion of sodium acetate had no effect upon a mixture of the solutions of strontium chloride and potassium bichromate, as at the end of eleven days no precipitate was visible.

For qualitative work, these tests were amply sufficient to give the proper conditions for the separation of the two metals. The potassium bichromate should be in the proportion of twenty or more grams to the litre, and enough sodium acetate should be added to form five or six per cent. of the whole.

Chemical Laboratory, U. N. C.

NOTES.

TAXODIUM (CYPRESS) IN NORTH CAROLINA
QUATERNARY.

So far as I am aware no fossil remains of the *Taxodium* have been described as occurring in North Carolina. But as the tree occurs fossil in the Tertiary of Spitzbergen, Greenland, Alaska and in the Rocky Mountain region, there can be little or no doubt but that it grew along the Atlantic slope during the Tertiary time. But however this may be, the stumps of this tree which I recently observed beneath a Quaternary shell deposit, in Craven county, show that it undoubtedly flourished in the State at this time.

Along the southwest bank of the Neuse river, 10—12 miles below the town of Newbern, the river bluff rises at intervals to an elevation of 18 to 22 feet above mean tide level. The surface layer of soil is a loam, changing into a clayey subsoil with but little show of stratification for a depth of 3 to 4 feet. Below this comes a laminated deposit of clay and fine sand of 10 feet, and under this comes a layer of shell marl, at some places 4 to 6 feet thick, reaching down to within 3—4 feet of water level. Beneath the marl comes a layer of dark colored stiff clay, and it is standing in this clay beneath the marl that the cypress stumps are to be found. Along the bluff for the distance of several hundred yards these cypress stumps are quite numerous, and some of them quite large, 4 to 6 feet in diameter. The majority, but not all, of the stumps are hollow. The roots penetrate the surrounding clay in every direction. At one point the action of the water has washed away the bluff and these fossil stumps stand out 20 to 40 yards from the shore line, their tops extending a few inches or a few feet above tide water. A few of them still retained the bark about the body of the stumps and roots; and in many cases on the roots can be seen evidences of the former existence of the cypress knees.

It appears likely that during the early champlain these cypress

trees grew in their present position. During the subsequent submergence of the coast line (of which there is abundant evidence) these trees grew in a sinking region. The trees dying, their stumps and roots were preserved by being surrounded and covered with sedimentary deposits.

University of N. C.

J. A. HOLMES.

ANALYSIS OF KAOLIN.

I. H. MANNING.

This specimen was secured by Mr. A. E. Wilson, near Hall's, in Jackson county, in the western part of this State. It was in the form of a compact lump, having a good white color which darkened very slightly on ignition. No signs of fusion could be observed before the blowpipe, nor were large gritty particles to be detected on rubbing in a mortar. The soluble matter present was determined by taking about 25 grains of the kaolin, boiling with water, filtering and evaporating a definite portion of the filtrate, weighing the residue. The soluble matter forms .088 per cent. of the whole.

The complete analysis is as follows :

SiO ₂	41.48
Al ₂ O ₃	37.09
Organic matter	12.60
CO ₂	2.22
H ₂ O	5.68
CaO .....	.18
MgO .....	.24
Na ₂ O } .....	.11
K ₂ O }	
Fe ₂ O ₃ .....	.31
S	trace.

No attempt was made at determining in what form this sulphur was present.

Chemical Laboratory, U. N. C.

THE TWISTING OF TREES.

During the past two years the writer has been interested in observing among forest trees the spiral arrangement of fibres of the trunk, commonly known as twisting of trees. These observations go to show, (1.) That all our common forest trees are occasionally to be seen with their trunks twisted. (2.) These trees are liable to twist in fertile as well as poor soils, shaded as well as sunny places. (3.) These trees may twist so that the spiral arrangement of the fibres is in the direction of the hands of a watch, or the reverse, and I have been unable to see that the one course was the more common or the other. (4.) This twisting is not limited to trees of any size, but is common among small as well as large trees.

University of N. C.

J. A. HOLMES.

A SPORT IN THE LEAF OF BLEPHILIA
CILIATA, RAF.

This is quite a common plant, usually found in dry open places throughout the Southern States. It attains a height of two to three feet; bears a small blue flower, with leaves *simple*, two to three inches long.

In the year 1877, at a point three miles north of Statesville, I found these plants with *trifoliate leaves*. A week later I found in the same place a plant bearing five-foliate leaves. Two weeks later I succeeded in finding a single specimen bearing eight-foliate leaves.

A sport of this kind with this plant is exceedingly rare. Time and again I have searched for duplicate specimens of these I have on hand, but in vain.

Statesville, N. C.

M. E. HYAMS.

ANALYSIS OF SPECULAR IRON ORE.

The specimen analyzed was gotten by Prof. E. A. de Schweinitz, from the neighborhood of Salem, in Forsyth county. It crumbled with comparative ease, and had a specific gravity of 4.719. The analysis resulted as follows:

Fe_2O_3	99.30
SiO_2 .....	.85
	<hr/>
	100.15

Tests were made for sulphur, phosphorus and manganese, but none could be detected. The specimen was, therefore, of a very high grade of purity.

I. H. MANNING.

Chemical Laboratory, U. N. C.

ANALYSIS OF RED HEMATITE FROM FORSYTH COUNTY.

The specimen was gotten from the neighborhood of Salem, in Forsyth county, by Prof. E. A. de Schweinitz.

The analysis resulted as follows:

Fe_2O_3	97.59
Fe	68.31
Mn .....	.10
S.....	trace.
P.....	trace.
SiO_2	2.80

A. E. WILSON.

Chemical Laboratory, U. N. C.

At a meeting held August 26th, the following resolutions were adopted:

Resolved, That the Society has received with the deepest sorrow the news of the death of its late President, Dr. Washington Caruthers Kerr. His kind words, cordial sympathy, and hearty co-operation have done much to strengthen and build up the Society. Even to the end was this interest kept up, and in the last week of his life he dictated two papers for the present journal. We feel how deep is our own loss, the loss to the State and to science everywhere, and we extend to his family our most heartfelt sympathy. The Society will treasure his memory and the example which he left of an earnest, faithful searcher after truth.

F. P. VENABLE,

Secretary.

J. W. GORE,

Vice-President.

GIFTS TO THE LIBRARY.

The Society is trying to make a complete collection of all scientific books relating to the State, and of all books, papers, or manuscripts showing the work done by its members. This collection will be very valuable, and as a suitable place has been set aside for its safe preservation by the University authorities, it is hoped that the members and friends will send to the Society any work of the kind in their possession. Gifts have already been received from the following persons:

Hon. Z. B. Vance, Dr. H. Carrington Bolton, Dr. F. P. Venable, Dr. W. B. Phillips, Dr. Thos. F. Wood, Dr. C. W. Dabney, Jr., Hon. Montford McGehee, Geo. F. Kurz, Pres. D. C. Gilman, Dr. Chas. Phillips, F. B. Dancy and H. B. Battle.

ROLL OF MEMBERS.

HONORARY MEMBERS.

Bolton, H. Carrington Ph. D., Trinity College, Conn.	Mallet, J. W., Ph. D., M. D., LL. D., University of Virginia, Va.
Chapman, A. W., M. D., Apalachicola, Fla.	Shepard, C. U., M. D., Charleston, S. C.
LeConte, Joseph, M. D., LL. D., University of California, Cal.	Southall, James C., LL. D., Richmond, Va.

MEMBERS.

Battle, K. P. Chapel Hill, N. C.	Hyams, M. E. Statesville, N. C.
Battle, K. P., Jr., New Orleans, La.	Horner, J. H. Oxford, N. C.
Battle, H. B. Raleigh, N. C.	Jackson, John W. Nashville, Tenn.
Battle, R. H. Raleigh, N. C.	Kenan, W. R. Wilmington, N. C.
Battle, T. H. Tarboro, N. C.	Kerr, J. P. Haw River, N. C.
Barringer, Rufus Charlotte, N. C.	Kerr, W. C. Raleigh, N. C.
Bingham, Robert, Bingham's School, N. C.	Ledoux, A. R., 10 Cedar Street, New York.
Blake, J. R. Davidson Col., N. C.	Lewis, R. H., M. D. Kinston, N. C.
Bruner, T. K. Salisbury, N. C.	Lewis, R. H., M. D. Raleigh, N. C.
Burgwyn, W. H. Henderson, N. C.	Love, J. L. Chapel Hill, N. C.
Cameron, J. D. Asheville, N. C.	Manigault, G. E. [C. M.] Charleston, S. C.
Cameron, Hon. P. C., Hillsboro, N. C.	Manning, Hon. John [L. M.] Chapel Hill, N. C.
Carr, Julian S. Durham, N. C.	Martin, W. J. Davidson Col., N. C.
Cheshire, Jos. B. Charlotte, N. C.	McNider, V. St. C. Jackson, N. C.
Cobb, Collier. Wilson, N. C.	Morehead, Eugene. Durham, N. C.
Craige, Kerr Salisbury, N. C.	Phillips, A. L. Burgaw, N. C.
Dabney, C. W., Jr. Raleigh, N. C.	Phillips, S. F. Washington, D. C.
Dancy, F. B. Raleigh, N. C.	Phillips, John L., Montana.
Deems, Dr. C. F., 4 Winthrop Place, N. Y.	Phillips, Wm. B. Chapel Hill, N. C.
Dupre, Ovide. New York City.	Phillips, Charles [L. M.] Chapel Hill, N. C.
Fries, J. W. Salem, N. C.	Pickel, J. M. [C. M.] Lake City, Fla.
Gore, J. W. Chapel Hill, N. C.	Pinnix, M. H. Lexington, N. C.
Grady, B. F., Jr. Albertyson, N. C.	Primrose, Wm. S. Raleigh, N. C.
Graves, R. H. Chapel Hill, N. C.	Radcliffe, Thos. Wilmington, N. C.
Green, Rt. Rev. W. M. [L. M.] Sewanee, Tenn.	Saunders, W. L. Raleigh, N. C.
Hanna, Geo. B. Charlotte, N. C.	Schweinitz, E. A. de Salem, N. C.
Harris, T. W., M. D., Chapel Hill, N. C.	Shipp, A. M. Nashville, Tenn.
Hays, John W. Oxford, N. C.	Simonds, W. F. San Jose, Cal.
Herff, B. Von. Raleigh, N. C.	Smedes, E. B. Raleigh, N. C.
Hill, W. E. Faison's, N. C.	Smith, P. E. Scotland Neck, N. C.
Holmes, J. A. Chapel Hill, N. C.	Spainhour, J. M., Lenoir, N. C.
Hooper, J. DeB. [L. M.] Chapel Hill, N. C.	Stamps, Preston Raleigh, N. C.
Howe, Jas. Lewis [C. M.] Richmond, Ky.	Stedman, C. M. Wilmington, N. C.
Hubbard, F. M. [L. M.] Raleigh, N. C.	Steele, W. L. Rockingham, N. C.
	Stephenson, J. A. D., Statesville, N. C.
	Summerville, J. H. N., Salisbury, N. C.

MEMBERS—CONTINUED.

Thomas, C. R.....	Newbern, N. C.	Wilkes, J. F.....	Charlotte, N. C.
Thomas, George G.,		Wilson, Jas. W....	Morganton, N. C.
	Wilmington, N. C.	Winston, Geo. T...	Chapel Hill, N. C.
Thompson, S. H...	Lexington, N. C.	Withers, W. A.....	Raleigh, N. C.
Vance, Z. B.....	Charlotte, N. C.	Wood, Thomas F.,	
Venable, F. P....	Chapel Hill, N. C.		Wilmington, N. C.
Wheeler, J. B.....	Lenoir, N. C.		

ASSOCIATE MEMBERS.

Baker, J. H., Jr.	McDonald, W. H.
Baker, F. H.	McGehee, L. P.
Beckwith, S. L.	McGuire, James.
Bryan, J. A.	Mewborn, W. E.
Butler, M.	Monroe, J. R.
Bynum, O. C.	Moore, G. D.
Costner, R. E.	Morris, J. A.
Cox, P. B.	Parker, Haywood.
Craig, Braxton,	Patrick, G. L.
Dockery, C.	Patterson, F. F.
Dunston, W. S.	Patterson, G. B.
Eller, A. H.	Roberts, J. C.
Faust, E. M.	Scull, St. Leon.
Feild, A. J.	Simmons, A. M.
Gill, E. J.	Smith, C. F.
Grandy, L. B.	Thomas, James.
Grimes, J. B.	Uzzell, K. S.
Howard, Geo.	Uzzell, R. L.
Jackson, Max.	Ward, A. D.
John, M. L.	Weill, S. C.
Latham, H. A.	West, J. F.
Little, F. M.	White, W. H.
Long, V. W.	Wilkinson, W. S.
Mann, J. J.	Wilson, N. H. D., Jr.
Manning, P. B.	

INDEX OF SUBJECTS.

	PAGE.
Action of Common Salt as a Wash	66
Additions to Curtis' Catalogue of N. C. Plants	72
Alchemy and Alchemists	7
Ammonia in Saliva	85
Analysis of Crystals of Dog-Tooth Spar	62
Analysis of Kaolin	93
Analysis of Leaves of Ilex Cassine	39
Analysis of Red Hematite	95
Analysis of Salt making Deposit	60
Analysis of Spiegel-eisen	46
Analysis of Specular Iron Ore	95
Analysis of Zinc Furnace Deposit	6
Arctic Explorations	6
Barium Chromate, Solubility of	90
Bibliography of Dr. Curtis	30
Blephilia Ciliata	94
Chapel Hill Well-water	6
Clay-eating	6
Common Salt as a Wash	66
Cypress (fossil) in N. C. Quaternary	92
Dog-tooth Spar	62
Domestic Life of the Romans	7
Eocene Deposits in Eastern N. C.	79
Flora of Angola Bay	6
Geodesy, History and Objects of	7
Geology of the Region about Tampa Bay, Fla.	86
Gifts to the Library	96
Heptyl-benzol, attempts to form	77
Ilex Cassine, Analysis of leaves of	39
Jetties at the mouth of the Mississippi	6
Kaolin, Analysis of	93
Latitude of Chapel Hill	32
Liquefaction of Gases	6
Luminiferous Ether, Theory of	6
Manufacture of Acid Phosphate	33
Mercurous Hypophosphite	78
Meteorological Record at Chapel Hill, 1880—1884	48
Meteorology, Use of Balloons in	6
Obituary notice of Dr. W. C. Kerr	8

	PAGE.
Observations of Thunder-storms by Balloons	6
Occurrence of Citric and Malic Acids in Pea-nuts.....	47
Pea-nuts, Citric and Malic Acids in.....	47
Peculiar Animal and Plant Life in Geology	6
Petrified Human Body	59
Plant Transpiration.....	63
Progress in Astronomy	6
Progress in Engineering	6
Report of Vice-President	3
Report of Secretary.....	5
Report of Treasurer	7
Report on the meetings of the British and American Associations	6
Resolutions with regard to the death of Dr. Kerr.....	96
Red Hematite, Analysis of.....	95
Reactions of Phosphorus.....	57
Roll of Members.....	97
Saliva, Ammonia in	85
Salt-making Deposit	60
Sketch of Botanical Work of Dr. Curtis.....	9
Solubility of Barium Chromate	90
Solutions (40) of Pons Asinorum.....	6
Specular Iron Ore, Analysis of.....	95
Spiegel-eisen, Analysis of.....	46
Sugar in Diabetes, Determination of.....	69
Tampa Bay, Geology of	86
Transpiration of Plants.....	63
Total Phosphoric Acid, Determination of.....	41



3 2044 072 223 175

Date Due

MAY 10 1955	
-------------	--

